Smithsonian

September 1989

Glowering tomcats from the menagerie of a young Chinese artist (p. 70)

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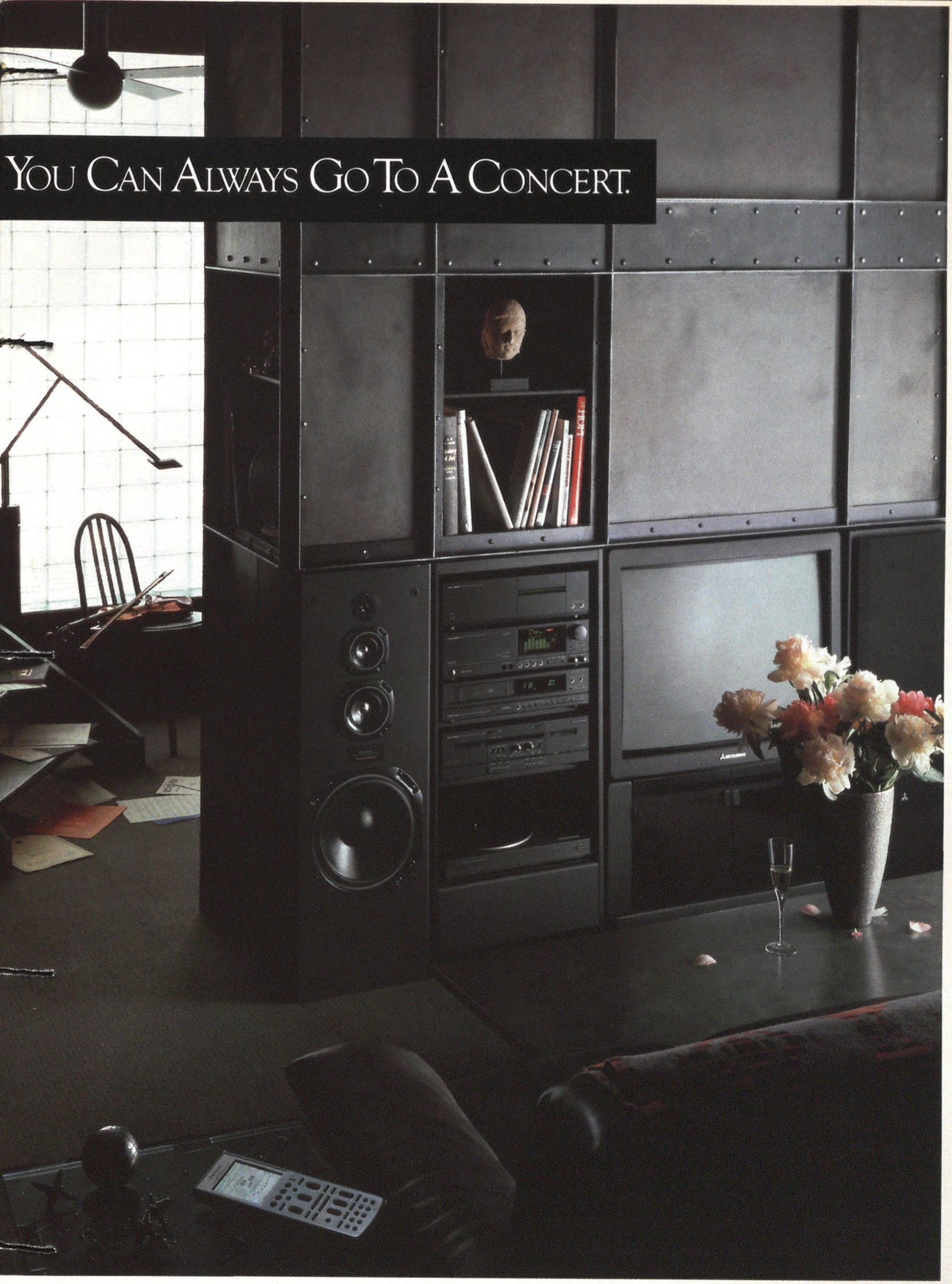
YOU CAN ALWAYS GO TO A CONCERT.

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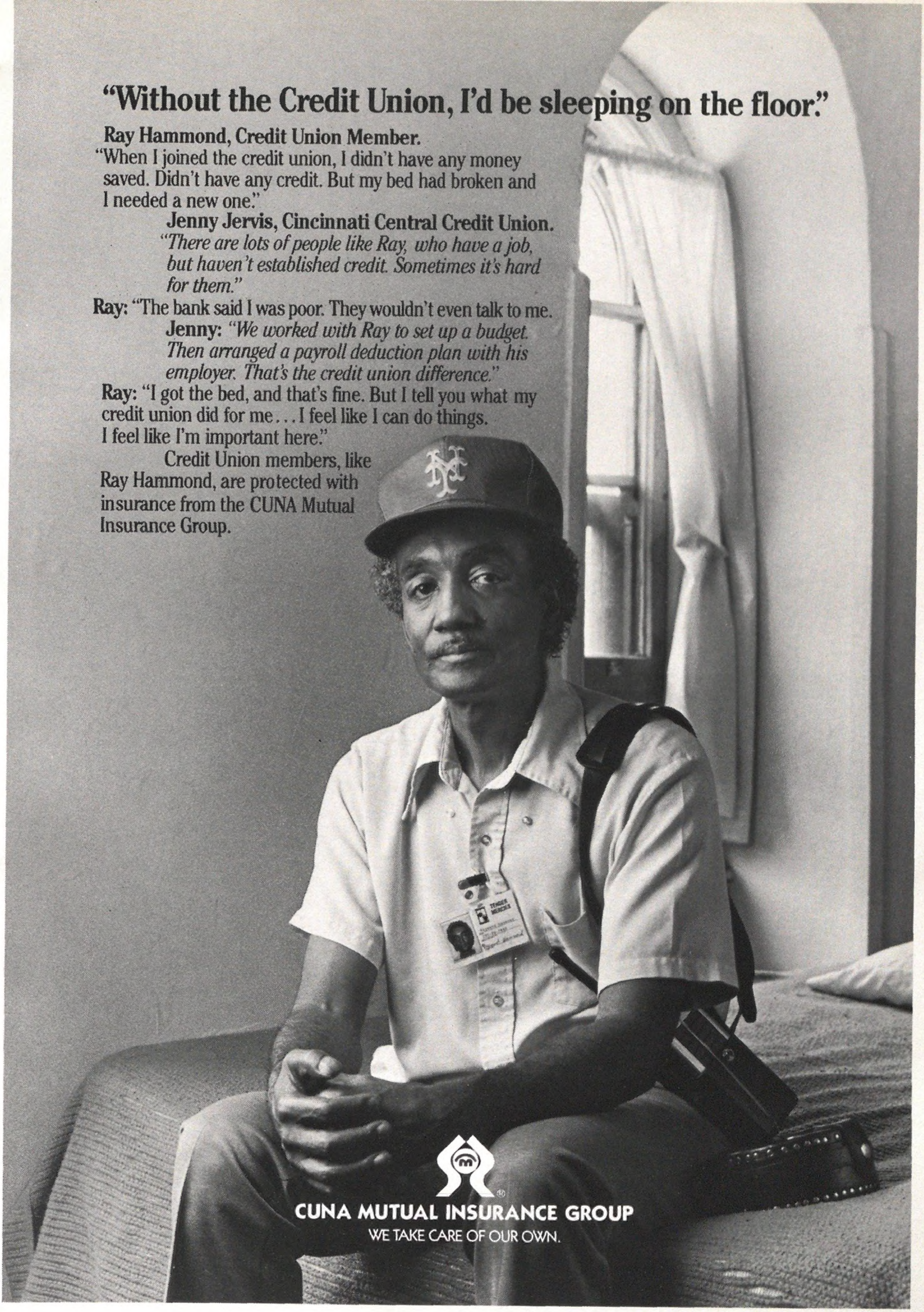

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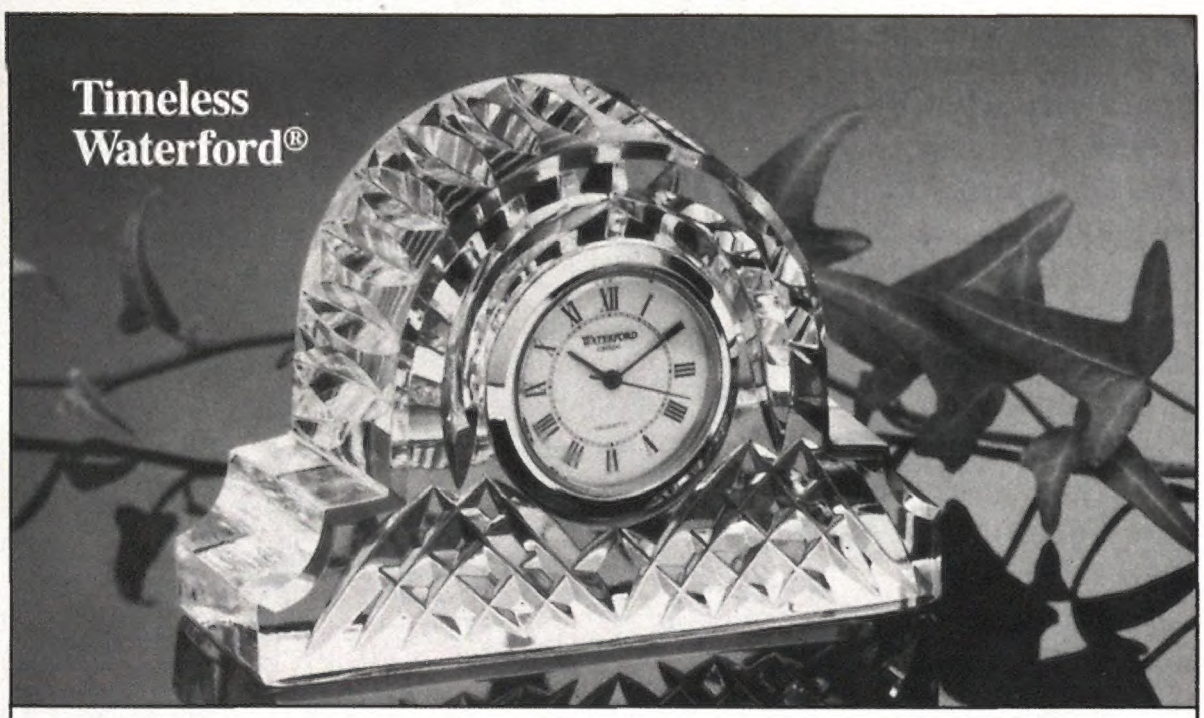

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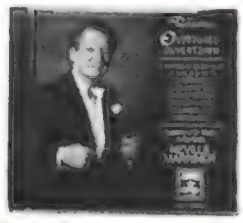

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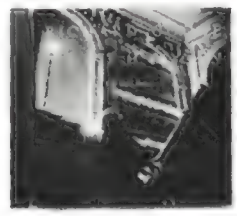

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Yo-Yo Ma, cello—Bach: Suites Unaccompanied Cello (CBS Master.) 339713-399717

Puccini Heroines.—Kiri Te Kanawa, Eva Marton, etc. (CBS Master.) 339242

Gershwin—Rhapsody In Blue; etc. Tilson Thomas, L.A. Philharmonic (CBS Master.) 339226

Mozart: Symphonies Nos. 40 & 41 (Jupiter). Kubelik, Bavarian Radio Symphony (CBS Master.) 339044

Bach: Sonatas For Flute & Harpsichord (cpl.); more. Rampal, Pinnock, etc. (CBS Master.) 336578-396572

Tchaikovsky—Violin Concerto; etc. Zukerman; Mehta, Israel Philharmonic (CBS Master.) 336461

Debussy—La Mer; Three Nocturnes, Previn, London Sym. (Angel) 335679

Berlioz—Symphonie Fantastique. Daniel Barenboim, Berlin Phil. (CBS Master.) 335547

Tchaikovsky—Suites from Sleeping Beauty & Swan Lake. Muti, Phila. Orch. (Angel) 334680

Handel: Great Choruses. Mormon Tabernacle Choir (CBS Master.) 333211

Mahler: Symphony No. 4. Kathleen Battle, soprano; Lorin Maazel, Vienna Phil. (CBS Master.) 332866

Brahms: Symphony No. 1. Tennstedt, London Philharm. (Angel) 332668

Bizet—Carmen and L'arlesienne Suites 1 & 2. Ozawa, Orch. National de France (Angel) 331595

Prokofiev: Peter & The Wolf; **Saint-Saens:** Carnival Of The Animals. I. Perlman; K&M Labeque; Mehta, Israel Philharmonic (Angel) 331322

Katia And Marielle Labeque—Gershwin: An American In Paris; more (Angel) 331314

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Handel: Water Music. **Jean-Claude Malgoire conducts La Grande Ecurie** (CBS Master.) 329615

Chopin—Polonaises, Mazurkas and Waltzes. Pianist is Ivan Moravec (Vox Cum Laude) 329144

Mozart—Piano Concerto 26; Rondos, Perahia, English Chamber Orch. (CBS Master.) 328740

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An Isaac Stern Vivaldi Gala—With Oistrakh, Perlman, Zukerman, others. (CBS Master.) 324525

Wagner—Orchestral Music. Mehta, N.Y. Phil. (CBS Master.) 323733

Beethoven—Symphony No. 5; Schubert: Symphony No. 8 Maazel, Vienna Phil. (CBS Master.) 321570

Mozart: Overtures. Marriner, Acad. St. Martins-In-The-Fields (Angel) 321224

Stravinsky—Rite Of Spring. Mehta, New York Phil. (CBS Master.) 281493

John Williams—The Great Guitar Concertos (CBS Master) 378638-398636

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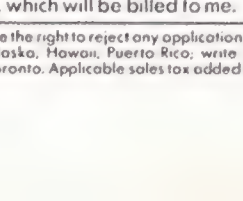

Andre Watts At Carnegie Hall (Angel) 376053

Leonard Bernstein, Cond.—Bernstein: The Encore Collection, Vol. I (CBS Master.) 371047

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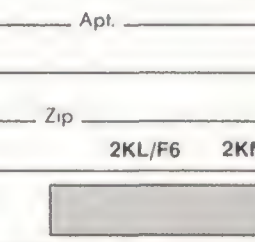

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Wagner: Overtures. Maazel, Philharmonia (CBS Master) 310086

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Debussy: Images (cpl); Estampes; etc. played by virtuoso Ivan Moravec (Vox Cum Laude) 328005

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Secretary Adams' comments

Smithsonian horizons

Whatever the real reasons, the hot, dry weather in Colorado this summer was blamed on the greenhouse effect

During weeks of growing anxiety, a dome of hot, dry, high-pressure air hovered over much of the Rocky Mountain West this summer. It forestalled the arrival of moisture-laden depressions that normally would have brought what is known (with local hyperbole) as the Southwest monsoon.

Compounding the searing effect of missing rainfall were cloudless skies and unremitting wind, so that forests and rangelands seemed almost ready to explode in the presence of a spark. The last few days of the spell, to be sure, brought preliminary indications of a break in the weather pattern. But emergency restrictions had already been in place for some time on virtually any rural use of open fires. Numerous locally destructive outbreaks had already occurred, each the subject of desperate efforts at containment. (For those of us who prefer to build and live in a semiarid, naturally wooded landscape, the threat of uncontrollable wildfires becomes a permanent preoccupation.)

Meanwhile the television weather reports told another story in other parts of this country. Tropical storm Allison came ashore in Texas, but apparently elected to stay rather than moving on in obedience to normal circulation patterns. Rain fell practically continuously on East Texas, Louisiana and the surrounding region, and throughout the Southeast rainfall was reportedly much above normal. High prevailing humidity may have created the impression of a steambath, but there was nothing exceptional about temperatures. So what else is new? Isn't weather always a problem in some place or other?

What's new, at least in the public's perception, is the assignment of responsibility for this to the greenhouse effect (*Horizons*, August 1987, October 1988). Carbon dioxide and other trace gases, known to be accumulating in the atmosphere as a result of fossil fuel consumption and other human activities, significantly reduce Earth's heat outflow in the form of infrared radiation. Virtually all authorities agree that a long-term tendency toward global warming is an extremely likely outcome. In other respects, however, wide margins of uncertainty continue to be freely acknowledged and the consensus is shakier. To mention just two (of many) complicating, poorly understood forms of feedback, the onset of changes in temperature could trigger secondary changes in oceanic absorption of these gases or changes in cloud cover. Either might strengthen or weaken the warming trend.

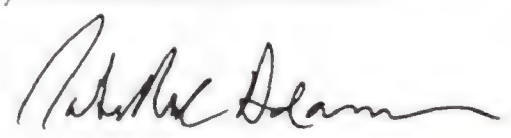
Climatic change, furthermore, long precedes human disturbance. Conceding that a natural warming trend has apparently been under way for something on the order of a century, perhaps in part as a result of solar variability, how do we distinguish its effects from those we have more recently induced? Temperature measurements, particularly when we attempt to construct long series of readings that are directly comparable to one another, are subject to much human as well as instrumental error and imprecision. Nor are worldwide patterns necessarily paralleled at smaller scales. Local conditions are largely at the mercy of concatenations of local meteorological factors like those that affected the mountain West.

For many such reasons, there are grave difficulties in accurately specifying the timing or amplitude of the changes to be expected from the greenhouse effect. Yet accurate estimates of the swings that will result from our present modes of consumption and transportation could have a crucial bearing not only on our readiness for measures toward greater energy efficiency but on many other international initiatives.

"How much would it cost for you people to get your act together and give us some precision on this?" I heard an official in the State Department acidly inquire not long ago, as a group of environmental specialists and science administrators was preparing to leave for a meeting on global change in Stockholm. We could offer sympathy but no firm answers. Some demands for information, particularly those necessitating ever-lengthening runs of improved statistics, cannot be met by immediately throwing money at them.

There is indeed an urgent case for greatly expanded research on all the intricately interacting aspects of global change, involving many disciplines and collaborating teams of investigators in many countries. But time will also be needed before even the most pressing issues facing the world's policymakers can be definitively addressed.

Meanwhile, those who would have evacuated their homes and cut fire lanes, or just apprehensively scanned the forested, tinder-dry mountain crests for wisps of smoke, understandably tended to jump the gun. They had heard, after all, a barrage of media predictions that a global warming trend due to the greenhouse effect is all but inevitable. What ultimately persuades most of us are not complex explanations or heterogeneous statistics spanning more than a human lifetime, but the anecdotal evidence we find immediately at hand. And so it happens that the greenhouse effect was alive and well in the minds of many Coloradans this summer.



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ASM2

Letters to the Editor

Complex organizations

Dear Sir: Surprisingly soon after reading Mr. Pfeiffer's July article, personal experience confirmed his observations.

On the evening of July 10, Wyckoff was visited by a "small" tornado. Two buildings of mine were without power. Next day the area was filled with repair and cleanup crews. A representative of the utility company, in business suit, hard hat and badge identifying him as an emergency services coordinator, came to my office. He told me the company was anxious to finish its mission of resupplying power quickly, but it was my responsibility to repair some damage before they could restore the power to my buildings. I asked him to write the details so I could relay them to an electrician. While he was doing so, three phone calls came from my tenants to tell me their power had been restored.

Obviously, the "operators" had seen and solved the problems while the "tasker" was still trying to define them.
Walter J. Kent
Wyckoff, New Jersey

Dear Sir: Having been an air boss on a carrier, one of the world's great jobs, I personally observed three occasions when cogs did in fact become big wheels. In one, a seaman on a cruiser took his ax on his own initiative and chopped the line dragging the ship's observation plane, about to be swamped in the wake. In another, a wave-off light flashed by an airman probably changed an imminent catastrophe into a manageable disaster. In the third, an airman overcame his initial panic when a helicopter caught fire on start-up, and ran back to stick a CO_2 extinguisher into the flaming exhaust pipe, thereby averting a most disastrous fire on the flight deck. In every case, but for the cog, the machine would have collapsed.
William C. Chapman
Arlington, Virginia

The French Revolution

Dear Sir: Dr. Guillotin, a member of the National Assembly, proposed in 1789 that all condemned to capital punishment be executed in the same manner, instead of having nobles decapitated and common people drawn and quartered. By 1792 the crossbeam bladed machine used in France was named *la guillotine* in his honor.

This type of machine had been used since at least 1553 in Italy, Germany, Spain, England and Scotland.
Maria T. Smith
Laguna Niguel, California

The National Zoo

Dear Sir: As a youngster in the late 1920s I used to visit my grandmother, who lived in Washington near the zoo.

About the time I learned to read I became aware of the sign "All lost children will be taken to the lion house." In later years I found it amusing, but at the time it was terrifying.
Edward H. MacDonald
Narberth, Pennsylvania

Dear Sir: After reading your July issue I put down my glasses. Suddenly, I felt someone staring at me. The lion tamarin [below].
James M. Gillis
Hull, Massachusetts

Dear Sir: One spring morning in 1956 I took my 4-year-old son to Rock Creek

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Park to the zoo. He loved all the exhibits, but after watching the orangutans having a marvelous time swinging on their trapeze and tires, he shouted gleefully, "That's what I want to be when I grow up! A monkey in the zoo!"
Henry A. R. Peyton
East Lyme, Connecticut

Women's baseball

Dear Sir: In high school I didn't like softball. The ball was too big—therefore harder to catch and to throw. It would slip out of women's small hands. So why not give the softball to the men and the baseball to the women?

Women today are just as tough, or more so, than men. I find it offensive to hear the game referred to as a "man's sport." Someone should have the courage to start an all-women major league.
Kandy Johnson
Hanceville, Alabama

Dear Sir: In 1958, when I was a fourth-grader, my family lived in France. As my father was in the Army, my fantastic mother, Vera, played amateur softball in the G.I. league. In one game she hit a home run. Eagerly, I chased the ball to keep as a souvenir. Finding it resting next to a heavy metal "ball," I proceeded to parade both trophies into Mom's dugout. As I was halfway in, all the women ran or tumbled out in a noisy mass exit. I had found an unexploded, live, World War II hand grenade! Since softballs were in short supply in France in the '50s, I could keep neither trophy. The game resumed after the bomb experts left.

I always looked up to Mom for getting out of the house and cracking a bat.
Don Heitsch
Elwood, Illinois

Tobacco

Dear Sir: In April 1974, my 52-year habit of smoking three and a half packs a day was painstakingly brought to a halt. So in June, financed in part by "saying NO!" to cigarettes, my wife and I took our first trip to Europe. Imagine the never-to-be-forgotten impact of scenting Bavaria's flowers and new-mown hay through the open windows of an electric train!

The second impact, too, was a body blow. In the Van Gogh Museum in Amsterdam, confronting us as we stepped off the elevator leading to the second-

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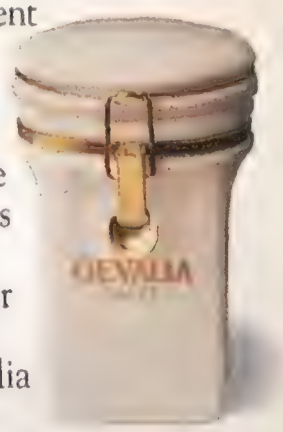

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floor gallery, was the artist's *Skull With a Burning Cigarette* [below].
Lars Ekwurzel
Deerfield Beach, Florida

Dear Sir: *The Complete Book of Emigrants, 1607-1660* by Peter Wilson Coldham reports that in January 1631, "The King [Charles I] directs that the planting of tobacco be limited in all places under the Earl of Carlisle's command because of the great abuse of tobacco to the enervation of the body and of courage."

And in the 1630s: "... the governor of Virginia is to rate every tobacco planter and ensure that none exceed their proportion for the King has long expected some better fruit from the colony than smoke and tobacco."
Mrs. W. K. Pagel
Beeville, Texas

Dear Sir: The statement about lung cancer being unrecognized as a disease until 1923 is in error. In 1921 the *Trattato di Anatomia Patologica*, edited by my grandfather Pio Foa, then professor of pathologic anatomy at the University of Turin, dedicated seven pages to this disease, citing 22 scholarly articles. The causal relationship between smoking and cancer was not even suspected.
Piero P. Foa, M.D.
West Bloomfield, Michigan
Although it is true that lung cancer had been described in various sources prior to 1923, it was not until that year that it was included in the International Classification of Diseases. Ed.

Dear Sir: In the back corners of society—soup kitchens, mental hospitals and prisons—the daily ration of cigarettes is almost as important as food. Smoking is considered a stress reducer or one of the few pleasures available to such people.

What are we saying when we speak out against smoking in restaurants, airports and office buildings, and at the same time distribute cigarettes to the mentally ill, the homeless and the incarcerated?
Judy C. Knupke
Newton, Massachusetts

Insect repellent

Dear Sir: In Shanghai, China, in 1947, we were moored in the muddy Huang-pu for a number of weeks. The mosquitoes there are bigger than the biggest ones in New Jersey and they know how to bite. Our reliable hospital corpsman had the solution. He loaded up a spray gun with kerosene and sprayed every screen on the ship. We had no mosquitoes in any of the living spaces, nor did they come in when the doors were opened; the fumes kept them out.
James C. Bidwell
Indialantic, Florida

Phenomena

Dear Sir: Having had the distinct pleasure of visiting Washington, D.C. during the holiday season of 1985, I know well what Mr. Wiley is talking about.

I make my home in California's San Fernando Valley, within a five-mile radius of work and all my daily needs. I find myself caught in the vicious cycle of not being able to walk because of lack of sidewalks and streetlights on all but major streets, or having problems finding parking.

I remember so well my trip to D.C. The weather was brisk and I lodged at the Hotel Washington, central to all. The only cabs I took were to and from Dulles Airport. This unaccustomed-to-walking Angeleno loved every mile spent outdoors, greedy for new sights. Returning to the hotel just in time for a quick change of clothing and a meal, I was off to the theater, on foot! My mind stimulated with a superb performance, I walked back to the hotel for a nightcap, a pleasant chat with the maitre d' and then to my slumbers. I sorely miss those walks.
Dita Vertefeuille
North Hollywood, California

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If you've ever owned fine collectibles, or admired those of friends or associates, you already know how rewarding 1989 American Eagle proof coins will be.

These fine collectibles will reflect your appreciation of not only enduring beauty and intricate detailing—but the hard work and pride that went into them.

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1989 Proof Eagles revive images from America's "Gilded Age." On the gold coins is Augustus Saint-Gaudens' "Liberty"—a design that inspired President Theodore Roosevelt to call the 1907 coin on which it first appeared "... the best coin that has been struck for 2,000 years."

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And these coins' beauty results as much from painstaking workmanship as from graceful images. Our minters prepare, strike and hand-inspect each coin individually to assure that the coins you receive are as flawless as the craft allows.

Coins are available individually in four gold sizes—one ounce, one-half ounce, one-quarter ounce and one-tenth ounce —or you can acquire the Four-Coin Gold Set. Purchase the one ounce Silver Dollar separately.

But you must act quickly! These magnificent coins will be struck only to order—*exclusively on orders postmarked by September 29, 1989.* To reserve your coins, simply fill in and mail the coupon below.

UNITED STATES MINT

These are *collector's proof* versions of American Eagle bullion coins traded by investors. The gold coins contain small amounts of silver and copper, added for durability. The proof silver coin is one troy ounce of .999 silver.

Specifications

coin	bullion content (troy oz.)	weight (troy oz.)	diameter (inches)
gold one ounce	1.0000	1.0909	1.287
one-half ounce	.5000	.5455	1.063
one-quarter ounce	.2500	.2727	.866
one-tenth ounce	.1000	.1091	.650
silver one ounce	.999	1.0000	1.598

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G39		1989 American Eagle Proof Gold (One-Quarter Ounce)	$ 150.00	
G49		1989 American Eagle Proof Gold (One-Tenth Ounce)	$ 65.00	
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S19		1989 American Eagle Proof Silver (One Ounce)	$ 23.00	
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Your order will be acknowledged in writing. Shipping will begin in October 1989, and continue for three months.

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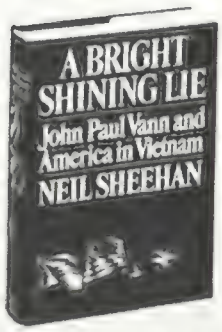

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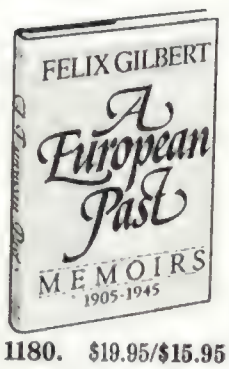

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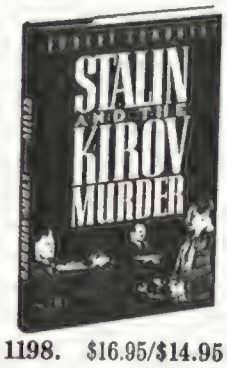

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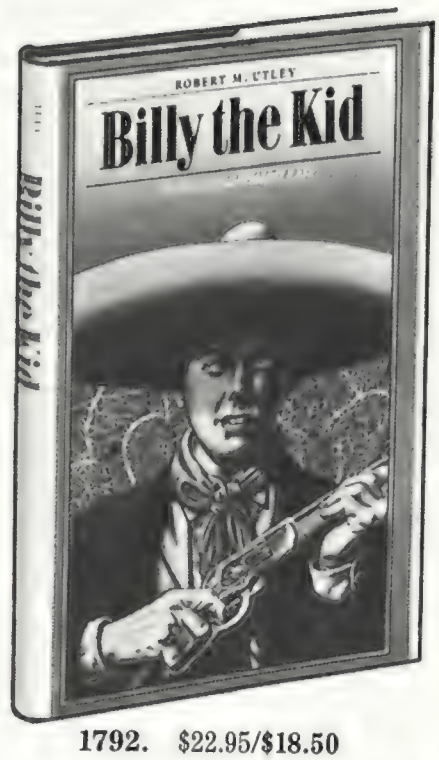

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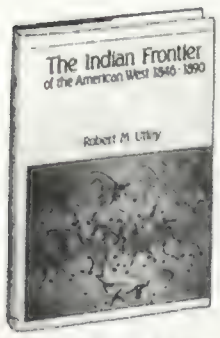

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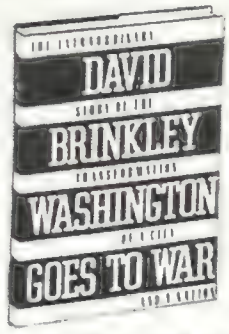

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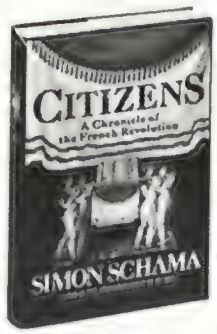

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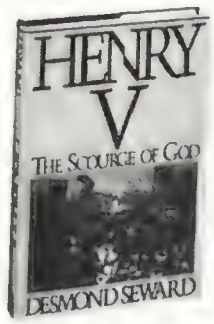

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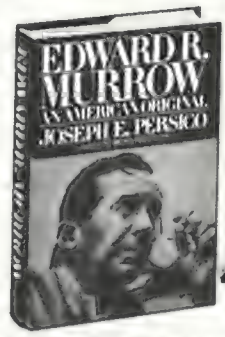

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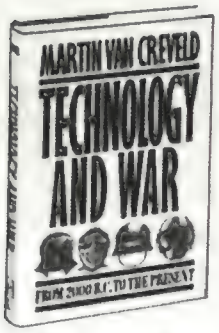

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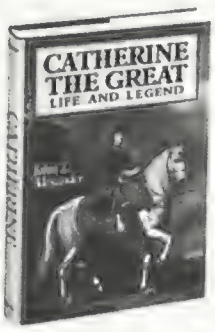

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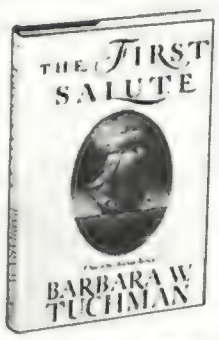

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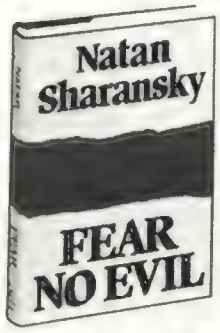

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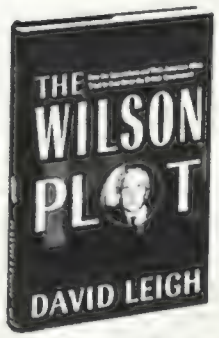

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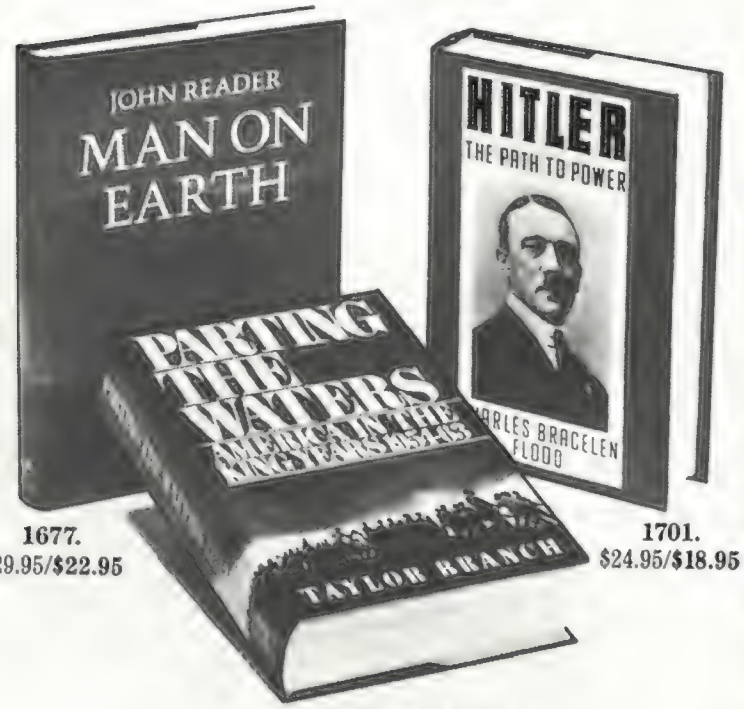

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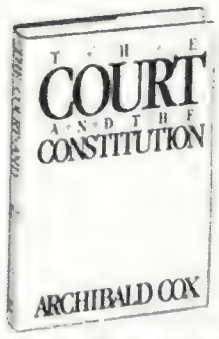

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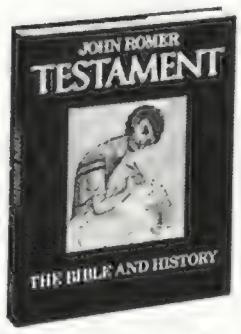

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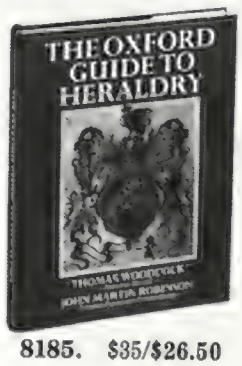

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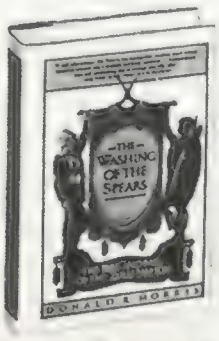

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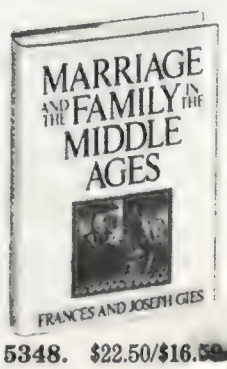

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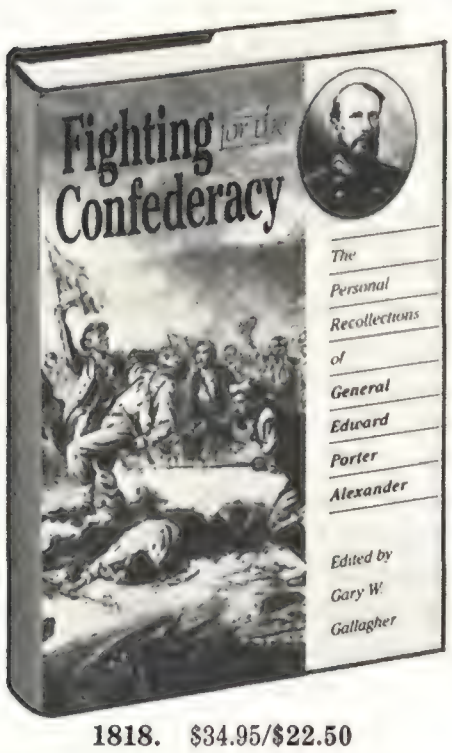
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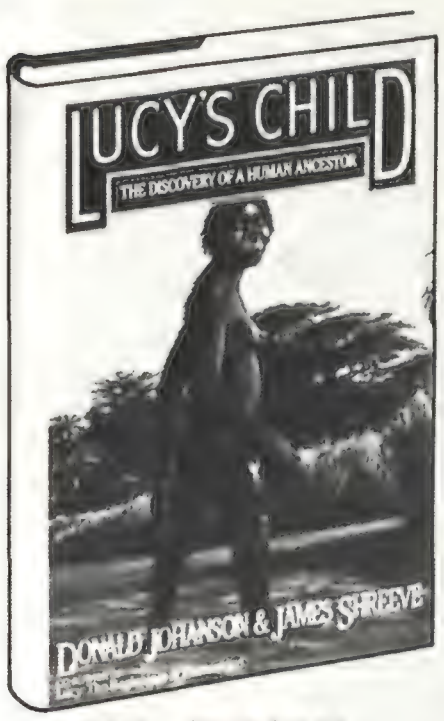

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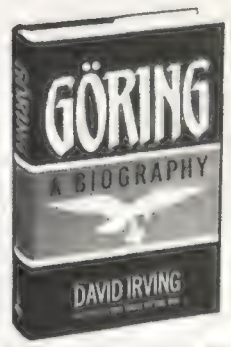

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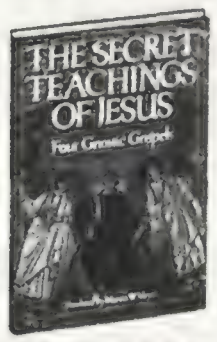

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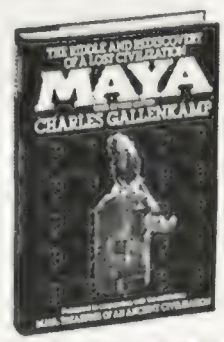

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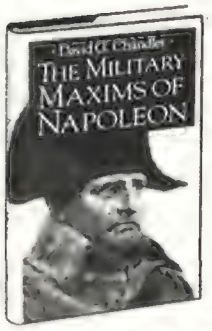

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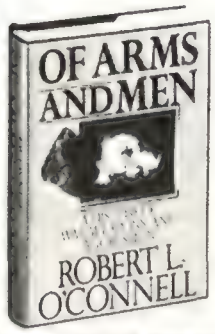

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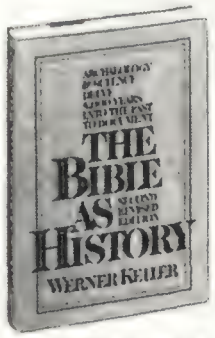

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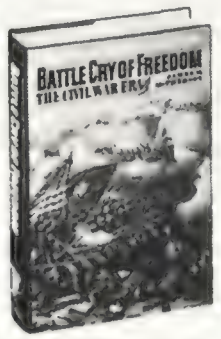

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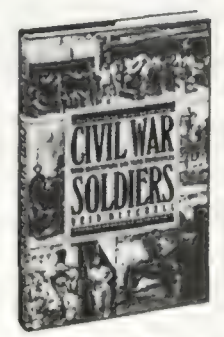

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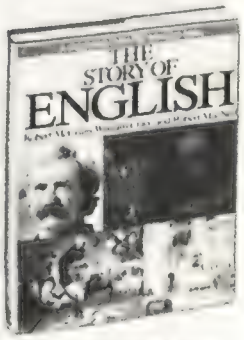

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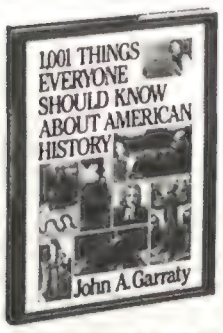

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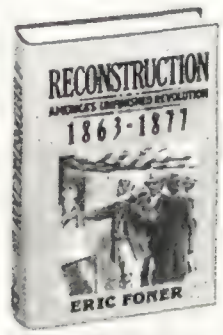

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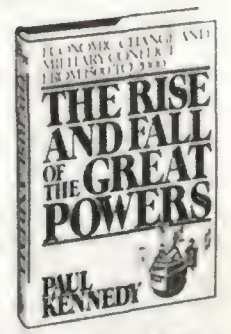

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Around the Mall and beyond

Since this magazine is well into its 20th year, these days we occasionally find ourselves recalling moments of importance during our birth pangs.

One such moment: the notion that Edward K. Thompson, our founding editor, had of inveigling Bradbury Thompson (no relation) to design the format of the magazine. "Bradbury Thompson is much too important," said we staffers, wisely. "He'd never bother." After all, he is one of this country's most innovative and effective graphic designers, preeminent in the design of our postage stamps, and equally famous for his work on highly visual magazines and limited-edition books. But our editor prevailed. In a day or two, there was Bradbury Thompson bending over our makeshift layout table.

"I thought SMITHSONIAN was a wonderful idea when Ed Thompson told me about it," he said recently. "And when I met Ed, I realized that his knowledge of his craft, like mine, came from working at it rather than sitting in a classroom. We're both hands-on guys."

People who talk like that often make the best teachers. Brad Thompson is as noted for 33 years of teaching at Yale as he is for the variety of work that has made him a national treasure in the world of design. This summer I visited him in Connecticut to see if some of that teaching skill would cut through my general artistic mindlessness. I felt I recognized him from his visit, 20 years ago, to our embryonic, meager editorial offices. He is still a strikingly handsome man, slender, tanned, silver-haired.

I knew that Thompson had received all the highest honors bestowed by his profession, and that he had influenced an entire generation of art directors and designers. I was also aware that his re-

cently published book, *The Art of Graphic Design*, had been lauded as a "major contribution to the history of graphic design." The volume took up a generous area of a coffee table in his broad-porched old house in Greenwich. We sat on the sofa and he reminisced.

"I worked on yearbooks and school papers in high school and college, back in Topeka," he told me. "At Washburn College—it's now a university—in Topeka, you had to be elected to the yearbook staff. If the book made money, the staff kept it. If it lost, they had to work to pay it back." Brad designed and edited two yearbooks at the college. He never had to pay back any losses, because there weren't any. "It may sound foolish, but I always tried to compete with my two favorite magazines, *Vanity Fair* and *Vogue*. Even in the heartland of America you can go for the best!"

Multiple color images merge with words to move model through rainstorm of type, in spread created by Brad Thompson for *Westvaco Inspirations*.

He graduated in 1934, joined a Kansas publishing house, then, like any young fortune seeker, headed for New York. "In the heat of August 1938, I toted a 5-by-4-foot portfolio from *Harper's Bazaar* to *Fortune*, Condé Nast and others. Among them was a printing firm, Rogers-Kellogg-Stillson. I got back to Topeka, and then, on a single October day, several offers arrived. One was from Condé Nast, publisher of my old favorites, *Vanity Fair* and *Vogue*."

No, he didn't choose it. Instead, he felt that the best chance to use his own ideas lay with those printers, "RKS" for short. They were the people who had been designing and printing *Westvaco Inspirations*, a periodical published by the Westvaco Corporation—a New York-based paper manufacturer—to showcase its printing papers. Under Thompson's direction, it became one of

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the leading avant-garde publications in the field of graphic arts.

During World War II, he was asked to join the Office of War Information, where he designed two magazines: *USA*, a small, condensed-style publication, and *Victory*, a large-format periodical in the style of *Life*. After the war, he freelanced widely, serving as art director for *Mademoiselle* for 15 years, design director of *Art News Annual* and *Art News* for 27, and consultant to magazines from *House Beautiful* to *Harvard Business Review*.

When Ed Thompson, who had been editor of *Life*, asked Brad Thompson to design the new SMITHSONIAN magazine in 1968, the latter was well aware of his prospective client's dedication to pictures. He knew that he would have to create a format that would "treat both pictures and columns of type with equal respect, yet allow flexibility in terms of picture size"—one that would have consistency and variety within a recognizable and readable framework. To that end, he created a set grid of column widths and depths. Pictures would vary in size, but would stay within the defined limits of that grid.

It was also important that the text stand apart from the ads. "For that reason, I wanted to use a consistent style of type. I felt that Baskerville was the best choice. It was classic (neither old-style nor faddish) and it echoed the historical background of the Smithsonian."

Thompson's work has probably been seen by just about everyone in the United States, for he is our country's most prolific designer of postage stamps. In his book he writes, "Stamps are a visual *haiku*, distilling a great deal of history, emotion and information." Of the more than 100 he's designed, the most popular is probably the "LOVE" stamp. The word is repeated five times, with the "V" depicted as a heart, each a different color. Nowhere near as well-known is his Washburn College Bible (SMITHSONIAN, June 1979), the award-winning, monumental project praised for its readability and beauty. Ten years in the making, the Bible dared to depart from the standard Gutenberg format.

Thompson reached down and picked up the first of its three volumes, huge and beautiful. Wordlessly, he turned its pages. On the frontispiece is a vibrant original screen print by artist Josef Albers. Each chapter is accompanied by a reproduction of a masterpiece—from Michelangelo's *Creation* to Rogier van der Weyden's *The Last Judgment*. The large-size type is set untraditionally in widely uneven lines, like poetry.

"The idea was to set the lines in the same cadence in which they're read," Thompson explained. "Just look at Genesis. Other Bibles print the words as standard lines—flush left and right—but these are set the way you read them":

> And God said,
> Let there be light:
> and there was light.

Brad Thompson likes to play games with type. In his book, he shows us how to create the effect of motion by repeating an image in different colors of ink, and how to make a mask out of a variety of letters and punctuation marks. He also toys with two ideas for new alphabets that would use only one graphic symbol for each of the 26 letters. For one, the "Monalphabet," he employs only the lowercase symbol for each letter. Uppercase is indicated by a slightly larger version of the lowercase form. This exercise reflects Thompson's belief that design should be based on integrity

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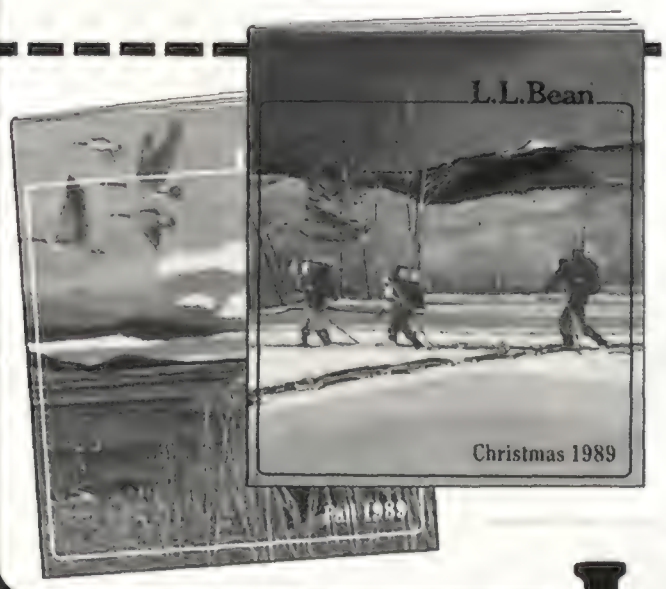

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and consistency. He pointed out how confusing it is for the beginning reader to have to recognize two different symbols—lowercase and uppercase—for most of the letters.

The special-edition books Thompson designed for Westvaco gently remind readers of how effective the selection and use of type can be. My own Westvaco edition of Ralph Waldo Emerson's essays groups four philosophical writings by the Sage of Concord. Here are some of its "Thompsonisms," pointed out to me by the man himself. On the dark gray book cover is a huge embossed "E," a subtle reminder of the author, hard to see because it is also dark gray. On the frontispiece is a round photograph of a Daniel Chester French bust of Emerson. It appears on the front and back of the page, as though it were a coin. For the rest of the illustrations, Thompson used engravings of Thomas Cole's series of paintings titled *The Voyage of Life*. A founder of the Hudson River School, Cole was an Emerson contemporary. "Both expressed the spirit of their time in these respective works—each in his own way," Thompson told me.

Open the book to "Self-Reliance," the first essay, and you meet with lines set, like the Washburn Bible's, in the cadence of Emerson's phrasing:

> To believe your own thought,
> to believe that what
> is true for you in your private heart
> is true for all men,—
> that is genius.

This is an extreme case of "flush left, ragged right," and you read it in this magazine's heads, subheads and most captions. Thompson made sure that you would. I asked the maestro about that odd, attractive, empty corner that often appears at the top left of a page or spread of text in SMITHSONIAN. The "Thompson corner," we call it. He looked a little puzzled, then found an issue of our magazine and hunted up an example.

"Now look," said the teacher. "You see how it tends to balance a gang of pictures on the facing page and adds relief to a page that would otherwise be a gray mass? Also, it provides a more inviting entry to a new page."

Whatever Brad Thompson did for us, we survived infancy and teen troubles, and are now nearly 20. Nearly an adult magazine. As I was leaving, he looked at me quizzically. "Thompson corner, eh? Was it named for Ed or for me?"

"For you," I said, instantly.

Edwards Park

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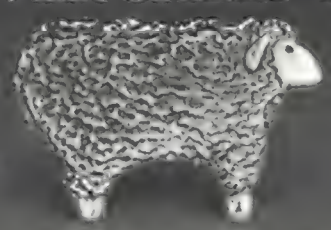

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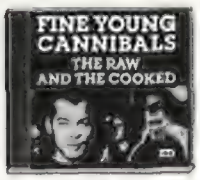

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R.E.M.: Green • Pop Song '89, Orange Crush etc. Warner Bros. **100715**

Mike & The Mechanics: The Living Years • Title song, others. Atlantic **100710**

Roy Orbison: Mystery Girl • You Got It, Windsurfer, The Only One. Virgin **100842**

Def Leppard: Hysteria Rocket, Women, Animal, Love Bites, etc. Mercury **100927**

Cocktail: Original Soundtrack • Bobby McFerrin, etc. Elektra **100459**

Pops In Space • The Boston Pops/Williams. Superman, others. Philips **105392**

100711

100789

101006

Bobby Brown: Don't Be Cruel • My Prerogative, etc. MCA **100621**

New Age Bach—The Goldberg Variations Spiegelman, synthesizer. East-West **100488**

Alabama: Southern Star Song Of The South, She Can, more. RCA **100914**

Cowboy Junkies: The Trinity Session • Sweet Jane, etc. RCA **101043**

Bette Midler: Beaches/ Original Soundtrack I Know You By Heart, more. Atlantic **100793**

Tesla: The Great Radio Controversy • Hang Tough. Geffen **100839**

The Cult: Sonic Temple Fire Woman. Sire **101015**

INXS: Kick • Need You Tonight, Devil Inside, New Sensation, Wild Life many more. Atlantic **153606**

Vangelis: Direct • The Motion Of The Stars, more. Arista **100470**

Barbara Cook: The Disney Album • When You Wish Upon A Star, etc. MCA **100854**

Classic Marches, • St. Louis Sym./Slatkin, Wedding March, more. RCA **100996**

Randy Travis: Old 8X10 Honky Tonk Moon, Deeper Than The Holler, etc. Warner Bros. **100008**

Kenny G.: Silhouette Tradewinds, Pastel, Let Go, I'll Be Alright. Arista **100603**

Dion: Yo Frankie Arista **100825**

Milli Vanilli: Girl You Know It's True • Title song, etc. Arista **101048**

Phoebe Snow: Something Real • Mr. Wondering, others. Elektra **101101**

Replacements: Don't Tell A Soul • I'll Be You, many more. Sire **101024**

Tone-Lòc: Lòc-Ed After Dark • Wild Thing, more. Delicious Vinyl/Island **101033**

Tchaikovsky, 1812 Overture; more. • Chicago Sym./Solti. London **125179**

Steve Winwood: Roll With It • Holding On, others. Virgin **154633**

The Original Recordings Of Charlie Parker. • Verve **101044**

Jody Watley: Larger Than Life • Real Love, Friends, many more. MCA **101104**

Beethoven, Sym. No 7, more. • Royal Phil./Previn, RCA **153621**

Crosby, Stills, Nash & Young: American Dream Atlantic **100714**

Metallica: And Justice For All • One, many more. Elektra **200478**

Dirty Dancing/Original Soundtrack • Hungry Eyes, more. RCA **182522**

Richard Marx: Repeat Offender • Satisfied, Angelia. EMI **101118**

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Winger • Madalaine, Purple Haze, Seventeen, more. Atlantic **100830**

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Phenomena, comment and notes

A simple piece of glass can reveal a secret world and turn the work of swimming into the sensation of flying

Longtime birders tend to throw a pair of binoculars in the suitcase whenever they travel, no matter how unpromising the destination. They never know when something will turn up. Sometimes you can spot a birder on a city street, in a high-rise office building, even on the beach: when something interesting is happening in the distance, one of the person's hands sweeps across the chest, instinctively groping for the glasses to get a better look. They have become accustomed to augmented vision and feel incomplete without it. (Some male birders tend to grope at their chest when an attractive woman comes into view in the distance, but that raises a whole other subject.)

The planet bristles with the telescopes of backyard astronomers, augmenting their vision as much as they can afford to in order to see our neighboring planets and distant galaxies. A smaller but equally dedicated group of amateurs uses microscopes to see another universe—that of rotifers and parameciums—that is invisible to the rest of us in our workaday world.

There is still another world we humans need augmented vision to see. For this one, too, we require glass but nothing in the way of fancy (i.e., expensive) optics. For less than $50 we can have all the quality we need, an object that fits into a suitcase as easily as binoculars and weighs a lot less. It is a diving mask, a piece of glass in a rubber-and-metal frame that fits over the eyes and nose. With it, we can see the underwater world, whether the coral reefs of the Caribbean, the rocks of the New England coast, even the local pond or creek.

Normally we are cut off from that world. From above, we can peer through the ripples with polarized sunglasses and make out a little. While swimming, we can open our eyes underwater and see blurry shapes. With a mask, we can see it all. Just that little bit of air in front of our eyes enables us to see: the shape of the corneas of our eyes requires that incoming light rays be refracted as they pass from one medium (air) to another (the liquid in our eyes).

Sit on the edge of a boat or stand in waist-deep water and the surface of the water might as well be a mirror, for all you can see. Put the mask on and duck your head under, and now the surface becomes the flat, silver sky over a new world of strange plants and stranger animals, one in which wild creatures stay out of reach but don't run away. Some will swim up to your mask with the curiosity of hummingbirds.

It is a new world in every way. Instead of floating in water, you are suspended in space. Swimming becomes flying, moving over the landscape like a soaring hawk. Now, like a hawk, you look down. When something strikes your fancy, you swim down for a closer look; when you are finished—or when your lungs begin sending an urgent message, which almost always happens first—you go back up. It is bird-watching upside down. The biologist and writer Marston Bates wrote in *The Forest and the Sea*: "In my forest I was always confined to the trunks of the trees, I had no way of getting out into 'interarboreal space'—I could be a poor sort of monkey, but I had no way of being a bird. In the sea I am one with the fish; I can float or dive or pause suspended in their midst. . . . Perhaps that is why I so much prefer fish watching to bird watching."

Swimming without a mask is refreshing, invigorating—and work. There is nothing like it at the end of a hot day, especially if you are old enough to be a little sore of feet, knees, hips. Weightlessness is a wonderful thing. But unless you are diving from a board, or body surfing, or getting in shape for the Ironman Triathlon, a little bit goes a long way. Swim until you tire (a frighteningly short time for some of us), float on your back and admire the sky, swim a little more—and wade ashore. Fifteen minutes is plenty.

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You don't have to swim at all. Let a boat drift before the wind. Put a seat cushion across the gunwale and lower yourself until your stomach is resting on it, your feet in the bottom of the boat and your head and shoulders hanging over the side. Scrunch around until you are reasonably comfortable. And then put your head in and watch the underwater world go by, as you waft above it like a hot-air balloon drifting over hill and dale. If that sounds too passive, hang on to a length of rope tied to the stern and have a friend run the engine ahead slow. The resulting sensation is remarkably like flying.

As a child I read too many books about underwater adventures. For my 10th birthday I asked for a knife to strap to my leg, presumably to fight off hammerhead sharks. But reality intervened. I tried spearfishing with the equipment of the day: a contraption powered by two strips of inner tube. An easy target swam by. I pulled the rubber strips back as far as I could and released the spear, a sharpened brass curtain rod. It touched the fish, gently, and dropped to the coral below. Since then I have left spearfishing to stronger types, but still use a mask whenever possible.

Last June and July I carried my mask where chance took me. In Massachusetts I swam off a state beach, over a flat, sandy bottom on which the only feature was occasional clumps of algae anchored to stones. Fish were few and far between. But hermit crabs pulled themselves along, with all their legs crowded together in the opening of a borrowed shell. Whelks, the temperate-water version of conchs, moved just as laboriously on their huge fleshy feet. Blue crabs would threaten when I swam down for a look, rising on their back legs and waving their claws.

In Bermuda a week later, I swam out to coral formations shaped like ice cream cones, first swimming down the outsides to admire the Mardi Gras colors of the parrotfish and angelfish nibbling on the algae, then pulling myself over the lip of the cones to swim among the unconcerned surgeonfish and sergeant majors in the interior bowl.

A youngster uses a diving mask to see the wonders in the water at his feet.

The sensation of flying would return as I swam out farther and the sandy bottom dropped away. For a moment, something like a fear of falling overcomes rationality, even though my mind knows that it requires effort to descend, and that if I do nothing I will stay safely at the surface.

You don't have to swim very far to see remarkable sights. Once in Bermuda, I was coming back to the shore, followed by a pugnacious pompano that had seemed not to like my swimming around its coral head. Just beyond where the waves began to break on the beach, I suddenly found myself in a cloud that stretched as far as I could see in that clear water, a cloud of translucent silver and electric blue. I was swimming through a school of what the Bermudians call fry, tiny fish almost transparent in the sunlight. I swam and swam, parallel to the shore, the fish parting before my face and regrouping behind me, filling the water from surface to sand.

When there wasn't time to go to the ocean, I swam in an anchorage with silty water, over a bottom littered with bottles, cans, tires (there is an unknown fundamental force in nature by which water attracts rubber) and the occasional hot-water tank. Needlefish threaded the surface; pufferfish, looking as if their tails had been tacked on as an afterthought, cruised the rocks. I picked up the tangerine-shaped exoskeletons of sea urchins and watched the progress of very alive, if improbable, sea cucumbers. Under rock ledges lurked mobs of gray snappers and French grunts.

Later, in rural Virginia, I went to the opposite extreme, wading in ankle-deep water in an unnamed creek. This ditch is not even "natural": it was dug 20 years ago to reroute the original stream. But when I came to the deep water, pools two and even three feet deep, I would pull on the mask and crawl in past the water striders and whirligigs to a small, hidden world. (The hardest part was trying not to think about the cattle upstream.) There I found equally curious sunfish under rock ledges, or swimming among the root tangles and tunneled mud of the banks. Sculpins waited for food where the water came splashing down from riffles; gauzy little egg cases attached to the bottom rocks undulated in the current. A crayfish danced with me. When I moved in, it would retreat into its hole alongside a bottom rock. When I backed off, it would emerge again, moving exactly as fast as I did. Back and forth we went, as though connected by an invisible bar.

Years ago I had tried a mask in a trout stream in the western Catskills. Not much to see, I thought on the first try, until I let the current carry me into a deep pool and dove to the bottom. Lurking in the glacial boulders there were fat fish a couple of feet long, giants compared with the hatchery trout fishermen worked so hard to catch. Chubs, people told me. Whales, I thought.

Science-fiction writers and theoretical physicists sometimes think about "gates" in space-time; move through one and you are in another part of the Universe—or another universe—and far in the past or future. We may someday learn to travel through these wormholes in the cosmos. But in the here and now, it is as easy as falling out of a boat to pass through the looking glass that is the surface of any handy body of water, and discover the universe on the other side. It is merely a question of augmented vision. And a diving mask takes up so little room in a suitcase.

John P. Wiley jr.

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Wind-whipped North Fork fire roars through trees along a creek on western side of park, September 1988. Cigarette butts started the notorious blaze in July; it burned until November 13, consuming 372,200 acres.

By Richard Conniff

Yellowstone's 'rebirth' amid the ashes is not neat or simple, but it's real

One year ago, the still-smoldering park was a disaster zone. Today, the complicated process of regeneration is well under way

One day this past June, when purple larkspur and brilliant green Idaho fescue were racing up through the scorched soil all over Yellowstone National Park, I went for a hike to a burned patch on the west slope of Mount Washburn. It was perhaps too desolate a place for a fair look into the reported "rebirth" of Yellowstone, the "new beginning" already being touted in color brochures by the same gateway-community merchants who just last year were calling Yellowstone a ruin. On Mount Washburn, the snow still clung to the rocky chutes running down to the road; spring had not quite arrived.

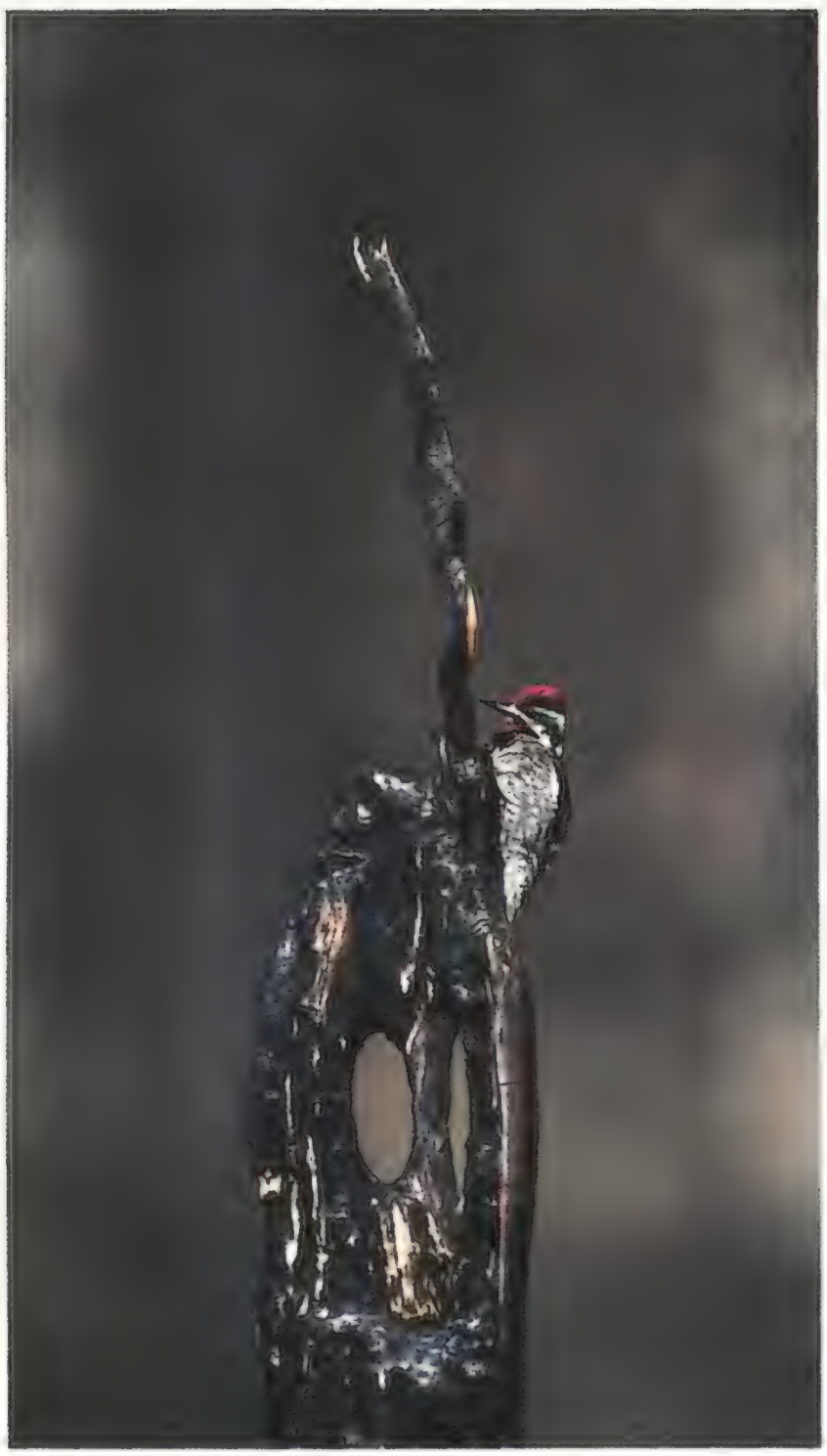
I was traveling with a National Park Service ornithologist, Terry McEneaney, a skinny, blue-eyed fellow skeptic in a scruffy red beard. We were talking about the likely effects of the fires that had burned almost half the park in 1988, and it had struck both of us that it was simplistic to talk about death and rebirth, bad news last year, good news now. Nature wasn't that quick; she could burn down a forest in a season, but growing it back was a more complicated business.

We were heading for a stand of thoroughly cooked trees on the edge of a high meadow. A winter of wind and heavy snow had stripped off the charred bark and burnished the bare wood underneath to a silvery

Blooming wildflowers brighten a charred stand of Douglas firs only seven months after North Fork fiasco was finally brought under control. Trees were hit by "canopy burn," which can go from crowns to ground.

Photographs by Alan and Sandy Carey

Swan Lake flats near Electric Peak in northwestern corner of park show the effects of burn in September.



Red-naped sapsucker perches on charred snag. After fires, birds were among first returning to burned areas.

brown. The meadow had already grown back, but among the trees the soil looked barren, and felt like the stuff you empty out of the bottom of a charcoal grill. Most of the dead trees around us were whitebark pine, bad news for grizzly bears, which like to fatten up on the pine seeds before going into hibernation. The fires killed as much as 20 percent of the park's whitebark pine, and the natural human impulse was to want it back, to want Yellowstone "whole" again.

"People, whether scientists or not, fail to remember that these are dynamic processes," McEneaney said. "Even the blackened forest isn't standing still. It's in motion. The human eye just doesn't see it that way." Branches would break. Trees would fall. Grasses and forbs (a generic term for small leafy plants) would start to appear. Insects were already recolonizing the area. Birds would follow. McEneaney thought flickers would come back first, and he was speculating on how soon, when we heard a sound like laughter.

"That's a flicker," he said. "Wait a minute. There's another one. That's a mating call." A big bird with a flash of red under the wing streaked overhead through the burn. A moment later another flicker landed on a blackened stalk of subalpine fir and disappeared into a new nest hole 40 feet up. "Isn't that amazing?" McEneaney called out, already heading down the slope to the fir. "It looks like nothing's here, and then you wait around a while and things show up."

He picked up a rock and rapped on the trunk of the fir. At the top, the flicker, a male with a red mustache, cocked its head out sideways and peered down, like a

In the spring (right), flats are beginning to green up; brown trees on hills between meadow and peak indicate areas where fires flared in patches. Shrubs and grasses in foreground sprout from root crowns at the surface.

peevish upstairs tenant. It was plainly at home amid the embers, and McEneaney was just as plainly gratified with the dynamic process. In time, he said, a gray-headed bird called the Clark's nutcracker would bring in fresh whitebark pinecones and cache them in the soil here, and some of them would produce seedlings. It would become a forest again.

If I was inclined to be skeptical—to wonder, for instance, how grizzlies would fare in the meantime—it was because I had last visited Yellowstone in mid-September 1988, when the fires were still smoking and emotions were on the boil. Back then, anything anybody said seemed suspect. The night I arrived, a local man in a hotel bar was angrily blaming the fires on the Park Service policy of letting "natural" fires (those ignited by lightning) burn, though that policy had been suspended since mid-July because of the drought. (It has always been Service policy to fight fires caused by people, and those that threaten life or property.) "They ought to start a backfire in Washington," the man avowed. "See how they like the smoke."

Also in the bar that night was a lingering contingent of the ambulance-chasing press, one of whom was loudly recalling how, while reporting on the Ethiopian famine, he taught the people in Addis Ababa to make pizza. The press, too, had generally liked the idea that the fires were a catastrophe and that the Park Service was at fault. Television viewers could easily have missed the point that drought and wind, not human policy, were the prime culprits. I'd seen the correspondents doing their wrap-ups in a burned-out wasteland on the road between Canyon Village and Norris, where only a few charred sticks remained upright. When they got the angle just right, they could make it look as if all Yellowstone had been firebombed. Hardly any of them mentioned an incidental detail: those trees had been knocked down by a windstorm in 1984.

But sober voices of authority were also offering rich source material for skepticism back then. "Let me tell you, colleagues, the ground is sterilized," Alan Simpson of Wyoming was declaring on the floor of the U.S. Senate. "It is blackened to the very depths of any root system within it." This was at a time when you could stop your car next to a three-week-old burn on the road to Old Faithful and find tender shoots of grass pushing up like a new lawn amid the incinerated trees. It had been Park Service policy, derived from the Leopold Report of 1963, to manage areas such as Yellowstone with a light hand, relying on natural forces like fire to create a "vignette of primitive America." Simpson argued that the Leopold Report had replaced science with "dewy-eyed" nostalgia. Fire was doubtless necessary in Yellowstone; no one wanted to return to the era when all fires were suppressed. But the way to put fire to work, he said, was through "prescribed burning" under systematic human control.

The Park Service staff at Yellowstone, harried on all sides, had meanwhile become locked into a sort of

Mr. Conniff's recent contributions include articles on roller coasters (August 1989), pet fish (May 1989), supermarkets (November 1988), mice (October 1988).

reverse-Bambi worldview, in which ungulates gamboled amid the flames and everything about the fires was good. Facing unfounded but widespread rumors of terrified elk going up in flames, some Park Service officials discouraged staffers from pointing out that forest fires do indeed take life, as well as give it. If the press exaggerated the scale of the fire, the Park Service tended to minimize it. (The press liked to report the fire perimeter, which was estimated then at 1.1 million acres. The Park Service wishfully implored them to add that "only about half of the vegetation has burned within many fire perimeters.") A reporter who asked if drought and fire would produce a severe winter kill among the elk and bison could get the official view: "For all we know, the animals are doing fine. If they weren't out making a living, they'd be migrating and we see no abnormal migrations." Then, in the corridors, he could overhear a researcher wondering why the collared elk in his study were coming down from the high country six weeks early: "Whether it's due to the drought or the fire, I don't know. But we're going to lose a lot of animals this winter."

John Varley, chief of research at Yellowstone, looks over an arrowleaf balsam root near singed Douglas fir.

Ornithologist Terry McEneaney stops to write notes while looking for birds near 8,564-foot Bunsen Peak.

Don Despain, a Park Service botanist, counts lodgepole seedlings in pipelike frame set up on burned plot.

The Yellowstone National Park to which I returned this past June was a much different place, and not simply because grass and wildflowers softened the starkness of the burn. In the absence of last year's vast, racing walls of flame, almost everyone seemed to have accepted the fires as a natural event. Tourists went about their customary business of photographing elk and bison, and their conversation was studded with tidbits of natural-fire philosophy. Stretches of graphite forest, where the burned tree trunks stood naked as pencil leads, followed the road in many places, and chain saws snarled where hazardous trees, or "snags," were being removed. But the general details of the fire were known now, and that horrible twinge of uncertainty, the idea that all Yellowstone could be lost in a season, was gone. Everything suddenly seemed green.

By preliminary estimates, 989,000 acres of the 2.2-million-acre park had been burned—a figure that, in the general atmosphere of rapprochement, was reported as "less than originally thought." In about 26 percent of that acreage the fire had burned into the treetops; the rest consisted of ground fires from which the park was already recovering with eye-popping speed. Surveys in the park had turned up 272 fire-related deaths among the so-called "charismatic megafauna"—elk, moose, black bear, mule deer and bison—though birds and small mammals probably died in far larger numbers. Drought and, to a lesser extent, fire damage also contributed to the heavy die-off of animals through the winter. Counting animals that wandered

out of the park and were killed by hunters, the elk population was down by 40 percent, bison by about 29 percent. Two grizzlies were missing and presumed dead. In addition, of the 25,000 firefighters who worked in the area in 1988, one died when a snag silently dropped on him during final cleanup operations in October. Secure in these statistics, a casual visitor could survey Yellowstone this past June and legitimately wonder what all the fuss had been about.

One morning up on the north side of Mount Washburn, I met an independent researcher named Steve French, who established the Yellowstone Grizzly Foundation in 1985. He was looking out at Antelope Valley through a telescope mounted on the window of his pickup truck. "Your average tourists," he said, "you figure their visual acuity going 40 miles per hour in a Winnebago—most of them aren't going to be able to tell that this was all burned." He pointed out splotches and stripes of black in the forest, and areas where trees had died from the heat. In some spots, twisted black spikes of sagebrush were visible above the grass. But these fire signs seemed incidental in what was otherwise a pastoral landscape of green grass and pockets of trees, among which groups of elk grazed.

Then French showed me his log entry for September 7, 1988, when he and his wife, Marilynn, having studied Antelope Valley for six years, drove there at the height of the blaze: "Fire everywhere we looked. My legs were weak. . . . Fire absolutely everywhere—up to the ridge, all in the upper meadows and interspersed trees, all below. The meadows were circled in fire rings. Trees were exploding/crashing/echoing constantly. . . . I can't imagine anything surviving in this entire drainage. It pains me to think of 300-year-old whitebark pine stands being evaporated in less than a minute. No signal from 125 or 126 . . ."

French assumed he was recording the deaths of the two radio-collared grizzlies. In fact, 126 simply moved out of the path of the fire; 125 stayed put, and French spotted her at her usual mineral lick the next morning. Other wildlife soon followed. When I talked to him in mid-June, the snow had been off the ground and French had been back studying Antelope Valley for less than a month. I asked what he'd seen so far, and this list tumbled out: three pairs of grizzlies courting and mating, two or three grizzlies digging biscuitroot or hunting elk calves or scavenging winter-killed carcasses, a couple of males passing through, looking for females; a herd of 175 elk, with a total of about 500 elk scattered across the valley at one time; moose, bison, bighorn sheep, a lot of small mammals, all sorts of raptors, mountain bluebirds, a blue grouse in rut, sandhill cranes—at which point I ran out of paper.

The Park Service had argued all along that the fires would increase biological diversity. The same day that French watched Antelope Valley burn, Terry McEneaney counted 40 ferruginous hawks, a prairie species seldom seen in Yellowstone, weaving through the heavy smoke in the Hayden Valley area. He theorized that such birds had evolved in their native fire-prone landscape to associate gigantic columns of smoke with a plentiful food source: voles and pocket gophers displaced by fire. Local eagles, ospreys, falcons, hawks, herons, cranes and owls also joined in the hunt.

Steve French, an independent researcher, scouts grizzly bears in Antelope Valley, where fire ran wild.

Bison cow nuzzles her calf near Madison River. Just nine buffalo died in fires; now they continue to thrive.

Elk herd spreads out across meadow near Obsidian Creek, where burning has stimulated growth of grass.

The wildlife show continued immediately after the fire. Many burned areas were littered with lodgepole pine seeds. (It was one of the most widely reported tidbits of natural-fire philosophy that about a third of Yellowstone's lodgepole pine have a special adaptation to fire, called serotiny. Their pinecones remain sealed up until intense heat melts the resin, scattering seeds and beginning reforestation.) Red crossbills, pine siskins and other birds, as well as a few intrepid chipmunks, quickly moved in to gorge on those seeds. It was easy to get the impression that park wildlife was better adapted to fire than were the human beings running around studying it, fighting it, deploring it.

The leading spokesman for the natural-fire policy last year was John Varley, chief of research at Yellowstone. Varley, who wears a trim brown beard and a snap-brim cap, is an ardent voice for wilderness preservation. A "fish-squeezer" (ichthyologist) by training, he helped reestablish native cutthroat trout in the park. On a wall in his cluttered office is a bumper sticker advocating "Wolves For A Greater Yellowstone." When I talked to him last September, Varley seemed frustrated not so much with the fires as with the resulting public relations debacle. "There is no 'let burn' policy," he snapped at one point, dismissing a term then in general use to describe the Park Service's natural-fire program. "You will never hear the words 'let burn' out of the mouth of a greenblood. It connotes that we sit back with our heels up, letting things happen."

By June, when I revisited Varley to talk about the park's changing diversity and the future of the natural-burn policy, he was more relaxed. He had been out with President George Bush earlier in the week, and the President had been so incredulous that a burned meadow could have grown back so fast that, with Senator Simpson looking on, the two of them squatted down to search for ashes beneath the grass.

What had been lost in the fires of 1988 were mainly huge stands of mature lodgepole pine, a slow-growing, long-lived tree that dominates the park. Such stands have a typical density of 200-300 trees per acre, and walking among the straight, branchless, tawny-gray tree trunks produces the uneasy sensation of being lost in a toothpick forest. The canopy shades out the sun, and the vegetation in the duff of dried pine needles consists mainly of lichens, moss and low, furzy patches of whortleberry; in older stands, seedlings of shade-tolerant spruce and fir begin to push up. It is good habitat for deer mice, red squirrels, a relatively sparse selection of birds and not much else. According to Varley, researchers sometimes refer to it unkindly as a "subalpine biological desert."

Fewer than 250 Yellowstone elk died from the fires; thousands perished in unusually deep snow last winter.

Thin cow moose shedding winter coat feeds on willows in an area rapidly recovering from spotty blazes.

In the 16 years since Yellowstone had introduced its natural-fire policy, lightning-caused fires had almost always established themselves in just such stands, and died out when they reached younger and less-flammable vegetation. When fire opened up the biological desert, said Varley, new plants and animals moved in. Such a forest harbored more species two or three years after it had been reduced to embers than before, and it became increasingly diverse for about 25 years, until the lodgepole pine once again began to cast its shadow. The only criticism directed at the natural-fire policy before 1988 was that it didn't burn enough; advocates of prescribed burning were positive that humans could do better.

"I will freely admit that we were very cavalier going into 1988," Varley said. "We had 16 years under our belt and by almost anybody's standards, it was enormously successful public policy. We let 235 fires burn, which consumed a total of 34,157 acres, with some fires ranging to 7,400 acres. I mean, good grief, we thought we had the cat by the tail. We were building a first-class mosaic." At that rate, it would have taken 675 years for fire to renew every corner of the park.

It seemed to me that, because they had always defended natural fire, Varley and the Park Service somehow by extension found themselves reaching for good things to say about the entire 1988 conflagration. It was as if, having declared that geysers were good for Yellowstone, they should also be obliged to speak well of a major volcanic eruption. "We might've overstated the benefits of the fire," Varley conceded. "Hell, it was easy enough to say when there were only 17,000 acres burned. It became less easy as it got up to three-quarters of a million acres."

What I wondered was if it was possible to predict the ecological effects of the fire even now. Previous fire research at Yellowstone had concentrated on burns of no more than 7,000 acres. Was it possible to extrapolate from there to a fire of almost a million acres? Since wildlife tends to be most diverse along the edges where differing habitats meet, could one honestly say that a more diverse mix of species would venture back into a vast, edgeless burn measuring in some places miles across? If reforestation depended on a natural "seed rain" from nearby trees and pinecones that survived the blaze, would areas in the middle of the largest burns remain barren?

"You can't come out and make definitive statements," said Varley. "We haven't had fires of this scale since there was a science of ecology. Types of habitats burned that we had previously believed were nonflammable. Swamps burned. We had crown fires through

Female osprey broods her eggs. Fires may have helped treetop nesters by opening up more potential sites.

Rare red fox is briefly distracted while hunting near a seared trunk. Park foxes vie with coyotes for prey.

willow. We think they'll be back. But that's a new dimension." He was confident that the park would respond as it had to smaller fires, "based on what you can go out and see today."

A couple of days after talking to Varley, I went out to a heavily burned area on the south side of Bunsen Peak. I was with a Park Service botanist named Don Despain, who has conducted much of the research on how fire affects plant life at Yellowstone. He is a placid, generally unexcitable man with an easy grin, but he became notorious around the West last year when he saw one of his research plots go up in flames and remarked, in the presence of a reporter, "Burn, baby, burn." (In Gardiner, Montana, on the edge of the park, a sign soon went up, "Snow, baby, snow.") We were standing at a place I'd last visited just after the fires, a knob of rocks and trees at the top of a slope, where the ash had come up around the ankles of my boots and the blackened rock was flaking off in layers from the heat. In my notes, I'd written, "All darkened trees. Zero leaves. Scorched earth. A dead zone." By June, the ash was gone and a few bold forbs and blades of grass had begun to grow. A fat yellow-bellied marmot waddled on the nearby slope.

Did a critter plant some trees?

Despain bent down and lightly fingered a pin-size green shoot in the shelter between two blackened rocks. "That's a conifer seedling," he remarked. "Maybe a Doug fir. I wonder where it came from." Unlike lodgepole pine, Douglas fir cones are not adapted to fire, and the local seed source seemed to have been thoroughly torched. Despain began to nose around among the rocks, until he found an active burrow with a litter of Douglas fir pinecones scattered around the entrance. An animal, possibly the marmot, which was by now whistling at us in alarm, had apparently survived the fire underground here. "The probability," said Despain, "is that the animal brought a cone out from under the rocks, and one of the seeds got away from him and is establishing a tree. It surprises me. I hadn't thought of an animal cache as a seed source in an area where the crown was completely burned." He mulled this over and then added, "The popular conception that everything is destroyed within these areas and that the seeds have to come back in from outside is a misconception."

Despain also disputed the idea that any part of the park had been burned so extensively that the mosaic edges were destroyed. "The mosaic pattern applies whether you're looking at the park from a satellite in outer space or crawling around on the ground." Flying over the park by helicopter, I'd seen the mosaic—improbable green islands in the middle of huge swaths

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Soon after intense fires blackened area near Tower Junction, packers move supplies across ashen terrain.

Riders cross same ground last spring. Vegetation includes lupine, grasses and perhaps 25 other plants.

of black. I also saw the opposite—spot burns that looked as if a prankster had spattered droplets of tar across the green forest. These different areas would come back at different rates, said Despain, and the "edge effect" would be preserved.

If Despain was unflappable in the face of last year's fires, it may have been because he and a colleague, William Romme at Fort Lewis College in Colorado, had just completed the fieldwork for a four-year study of fire history at Yellowstone. Despain and Romme had concluded that huge conflagrations occurring centuries apart were the natural-fire pattern in Yellowstone's lodgepole pine forests—and they conveniently announced this in August 1988, as the winds were starting to kick up and drive the flames across tens of thousands of acres in a day. Their study turns out to be important to the future of Yellowstone and to the issue of natural fire versus prescribed burning.

Critics of the Park Service have argued that the only reason half of Yellowstone burned last year was that a century of fire suppression had caused an unnatural buildup of fallen trees and other ready fuels. In their view, the Park Service should have begun prescribed burning to remove those fuels even before fire suppression ended in 1972.

Despain and Romme argued that the fuel buildup had been entirely natural because the park's lodgepole pine typically burned at 200- to 400-year intervals. Fire suppression had been too recent—and too ineffective before the introduction of aerial equipment—to make much difference. By looking at large tree stands that had grown up together in areas once cleared by fire, Despain and Romme concluded that Yellowstone's forests had last experienced widespread fire, with individual burns of at least 40,000 acres in size, in the early 1700s. And having lived through it before, the park would readily adapt without human help, once again. In Despain's view, the scope of the 1988 fires did not contradict the natural-fire policy but established its historical validity.

Despite Varley's fears that the fires would "give the antiwilderness people a new jump-start on life," the natural-fire policy thus seemed to have survived all the political hubbub of last summer. When I talked to him, Varley was not bothered by the Bush Administration's order to suppress all fires this year and possibly next. Scientists in and out of government had rallied behind natural fire. With that backing, Varley argued that it was a sound decision, in practical and also political terms, to back off until the park had revised its fire-management plan.

But if the fire debate had subsided as of the spring, it continued to simmer under the surface, a conflict of two antithetical ideas. Was nature capable of managing Yellowstone Park without human meddling? Or did nature require human dominion to survive in the modern world?

Shortly after I visited with Despain, I spoke by phone to one of his critics, Tom Bonnicksen, a professor at Texas A&M and a specialist in restoration ecology. Bonnicksen didn't dispute the Park Service contention that Yellowstone will experience a regeneration of plant life after the fires. But it followed logically, he said, that lodgepole pine seedlings would

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One of park's charismatic creatures, male elk pauses in meadow; antlers will shed velvet by early fall.

begin to push up and form a canopy. In time, huge areas of the park would be covered with forests of uniform age and size, a vast new biological desert.

In Bonnicksen's view, the mosaic *was* destroyed, in more than half the area burned. Such a forest was likely to produce a new round of wildfires in 50 to 100 years, when the combination of a low canopy with underlying debris left over from last year's fires would be "explosive," and again after 200 years, when spruce and fir formed a "ladder of fuels" up to the canopy. Bonnicksen's answer was to begin prescribed burning. And if Despain could cite a study showing that a prescribed-burning program begun in 1972 would not have had time to prevent last year's fires, that was merely an argument, in Bonnicksen's view, for beginning such a program now before it was again too late.

Thus the fires of 1988 produced no resolution of the debate over wilderness management, not even a guarantee that the other half of the park won't burn next year. They merely demonstrated once again that the two constants in any wilderness are debate, generally bitter, and change, sometimes drastic and surprising.

Up in Antelope Valley, Steve French was telling me in a roundabout way why he was not worried about his grizzlies. "People don't like change," he was saying. "You want your rent to be $300 a month. You don't want it to be $25 one month and $5,000 the next. We like things to be in a steady state. But nature isn't like that." Change at Yellowstone had been drastic before. I thought of a headline from a Chicago paper: YELLOWSTONE IN SHAMBLES. The article described what was then considered one of the worst earthquakes in American history. It knocked 1,300 feet off a canyon wall, dropped around 40 million cubic yards of rock into the Madison River drainage and killed 28 people. That epochal event, which occurred just outside the park 30 years ago, is now largely lost to human memory.

"Grizzly bears evolved adjusting to a changing habitat," said French. "They've got claws for digging. They've got teeth for crushing. They've got the long gut so they can eat on vegetation." Fire may have taken away some of their whitebark pine, but it also provided carcasses to scavenge, and the "nutrient pulse" from the ash helped push up a rich crop of grazing grass this spring. "The grizzly is an animal that evolutionarily and annually and seasonally can adjust to change," French added. "And what was the fire? Not good nor bad, but change."

Out on the Canyon-Norris Road, tourists were stopping by that old blowdown they'd seen so often on television last year. A father stood his 3-year-old on a burned log and the mother edged from side to side seeking the choice angle, so that Yellowstone would appear in the background as a flattened wasteland stretching clear to Mount Holmes on the western border. "Look at your mother," the father said. "*Look . . . at . . . your . . . mother!*" A ranger came by and gamely explained that this landscape was not, strictly speaking, a product of the fires. People listened politely, then returned to their camera work. This was one place in Yellowstone that still smacked of a major news event. A catastrophe. They wanted to bend down and rap their knuckles on the hardened earth. They wanted to touch it, to immortalize it before it, too, was subsumed in the rising tide of nature.

No Smokey here, a startled black bear in a partially burned forest hugs a tree as if seeking reassurance.

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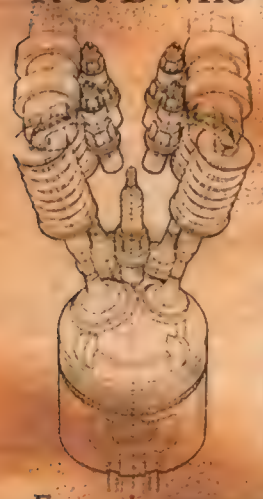

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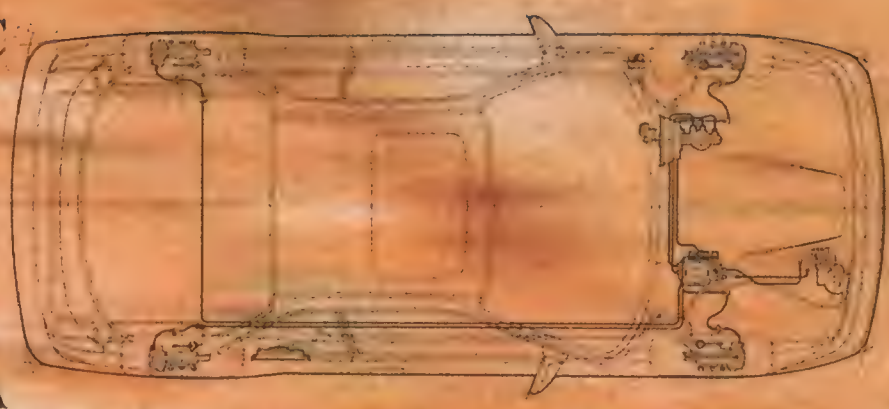

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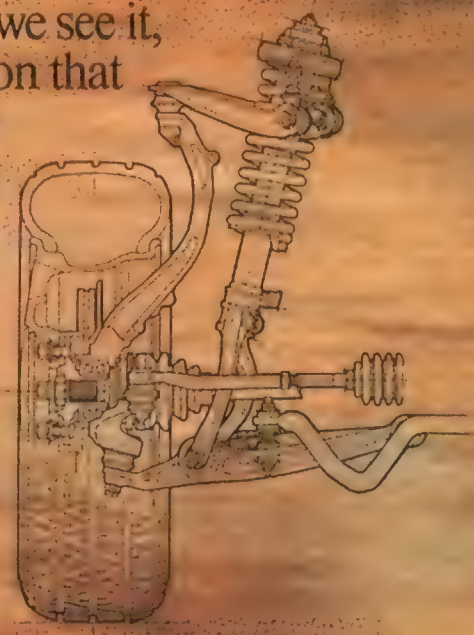

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Comfrey Hospital, in this quiet Minnesota town of 500, is the state's smallest—it has only eight beds.

By Richard J. Margolis

In America's small-town hospitals, a patient isn't 'just a number'

Yet its modern facilities include an operating room, outpatient clinic and 24-hour emergency room.

Rural America's local hospitals are facing an economic crisis, but their existence is often what keeps the communities alive

It happened one August night without warning, while our family was vacationing on an island off the coast of Maine. One moment Philip, our 12-year-old, was on a porch rocker joking with us; the next he was on the bare floor writhing in pain.

In a panic I carried Phil to his bed—he couldn't walk—while my wife, Diane, ran to get Alex, a Boston internist who happened to be summering at the cottage next door. "Torsion of the right spermatic cord," Alex pronounced, gazing down on our stricken son. Somehow a vital connection in Phil's groin had gotten twisted. The warp was choking off his blood supply.

"I've only read about such cases," Alex confessed. "Never actually saw one before."

Very tentatively he reached down and touched the tender area. Phil jerked and let out a howl. "Sorry," Alex muttered. He took Diane and me aside. "I think we better get your boy to St. Andrews right away. For something like this you don't want to wait too long."

St. Andrews Hospital lay an hour across the water in the little town of Boothbay Harbor. Could people who worked in such an out-of-the-way place be expected to possess the skills our son so urgently needed? We had our doubts, but there was no time to speculate. With another neighbor's help, we managed to get Phil down to the dock and onto a borrowed boat equipped with an outboard motor. In smooth, dark water we sped off, following a streak of moonlight that seemed headed toward Mill Cove and the hospital dock. Not another soul was on the bay.

"Maybe I can unravel this thing for you"

Alex had telephoned ahead. A nurse with a wheelchair and a blanket awaited us at the pier. Within minutes Phil was lying on a bed in the emergency room and being examined by a man who introduced himself as Dr. Gregory, a large man with lots of gray hair and a reassuring voice. "Let's see what we have here," he said to Phil. We held our breath and watched as the doctor's long fingers searched for the offending knot. Phil's body stiffened but he made no sound. "Just relax," Dr. Gregory murmured. "Maybe I can unravel this thing for you."

Between his thumb and middle finger the doctor was delicately kneading the invisible rope. Suddenly Phil's muscles went slack; he emitted a deep sigh. So did we—for it was plain that Dr. Gregory's educated fingers had untwisted the cord.

He patted Phil on the shoulder and stood up. "We'll want to keep you here overnight," he said, "just in case that thing decides to get troublesome again. You don't mind spending the night with us, do you?"

"Nope," Phil said. And for the first time in five hours, he smiled.

Photographs by Gail Mooney

Dr. John Hahn delivers twins by C-section at Grant Memorial Hospital, in the mountains of West Virginia.

All of the above occurred 19 years ago. Through the intervening years, until very recently, I held to the idea that our family's luck that scary night had been extraordinary, that in St. Andrews we'd happened upon a rare rural gem. Now I think otherwise. One of the many things I have learned from a recent round of visits to rural hospitals in several states (including an eye-opening return to Boothbay Harbor) is that our good fortune was just a routine entry in the annals of small-town medicine.

The knowledge has taken some getting used to. We live in a city that boasts two major hospitals, one with 491 licensed beds, the other with 875. Each in its way typifies the sort of high-powered, university-affiliated complex that most city dwellers equate with first-rate health care. By contrast, an urbanite's mental picture of a rural hospital is likely to resemble a faded turn-of-the-century etching, featuring ornate Victorian architecture, generally shabby upholstery and hopelessly primitive equipment.

Such hospitals did in fact once dot the rural landscape. Writing a half-century ago, here is how Arthur E. Hertzler, a Kansas country physician, reminisced about those early institutions in his autobiography, *The Horse and Buggy Doctor.* In his youth, Hertzler recalled, the typical small-town hospital was "in a private residence. . . . Sometimes the doctor and his family lived downstairs and the wife did the cooking. . . .

"Usually half a dozen or fewer hospital beds found available space in these houses. The operating room was usually the bedroom of the former cook. . . . The kitchen stove usually supplied the heat for the sterilization of the instruments and dressings. This made it necessary for the doctor to eat an early breakfast, so that the stove could be available as a sterilizer when it came time to prepare for the operation. Operating in such hospitals was but slightly removed from the kitchen surgery of any private residence. . . .

"It is enough to make one weep," Hertzler mourned, "to think back on those early beginnings."

Urban medical centers in miniature

These days the good doctor would not have to weep. The hospitals I visited were indeed small in comparison with their big-city cousins—they ranged downward from 73 beds to a mere 8—yet they gleamed with modernity. In most instances my first impression was that of an urban medical center in miniature. Even the most Lilliputian of them all—the one in Comfrey, Minnesota, with its eight beds—boasted an outpatient clinic, operating and recovery rooms, a blood bank, a pharmacy, a 24-hour emergency room, delivery and nursery facilities with two bassinets, and social services. Many maintained intensive care rooms equipped with

monitors that could flash the jagged trajectory of a patient's heartbeat.

But rural hospitals do not compete with their urban counterparts—at least not in cases requiring the more exotic skills and technologies. "Don't come here if you need open-heart surgery or a kidney transplant," says Dr. Matthew J. Rimas, Comfrey Hospital's only full-time physician. "But for most illnesses you can get as good medical care here as you can anywhere." (Like many small hospitals, Comfrey has access to a helicopter for emergency transport of patients whose ailments defy the hospital's healing powers.)

Even as I sketch this picture, however, I have an uneasy sense of having left out its most remarkable feature. Call it one-on-one graciousness; call it sympathy; call it, for lack of a better pun, small-town hospitality. Whatever the label, it is a force that operates at the very center of most rural hospitals in America. Yet it is so universally taken for granted, that hardly any of the scores of doctors and nurses I talked with seemed conscious of its presence.

"Do you do anything special for bereaved families?" I asked a nurse at Grant Memorial Hospital, a 59-bed facility tucked into the mountains surrounding Petersburg, West Virginia.

The nurse, a veteran of many years' service, gave the question considerable thought. "No," she finally answered, "I don't recall our ever doing anything out of the ordinary for the bereaved. Oh, sure, we cry with them and we sing with them and we pray with them. But no, nothing you could call special."

Pies from scratch, real mashed potatoes

A rural hospital, then, may be a place where nothing "special" ever happens. Where no one is a number; where everyone knows your name, tolerates your quirks and shares your griefs; where the nurses celebrate your birthday. Where, when you telephone to say you feel sick and wish to be admitted, they turn down your bed and have the florist deliver a half-dozen pink carnations to your room. Where visiting hours do not matter even if they are posted—relatives and friends come and go as they please; where a turned-on light over your door instantly brings a nurse to your bedside. Where the kitchen staff makes bread and pies from scratch, and *real* mashed potatoes, and if you don't like the evening menu, someone will run to the corner and bring you a pizza with mushrooms and onions—and no anchovies. Where your tattered pajamas may be mysteriously replaced one evening by a brand-new pair, with the price tag removed. ("For what us nurses make around here," one of them at Grant Memorial marveled, "we sure are free with our money.")

Such everyday dispensations are all duly recorded in my notebooks. They have become part of my education. From them I conclude that small-town hospitals draw energy from secrets all their own: within the national health care system, they emerge as unique institutions where the curing and the caring are one and indivisible.

At Grant Memorial I was introduced to a patient whose lengthy sojourn there—not yet over—perfectly illustrates the bond between caring and curing. The patient's name is Shane. He is a dimpled, brown-eyed infant born about three months prematurely on January 14, 1988, at West Virginia University Medical Center in Morgantown.

Shane had two and a half strikes against him. Within weeks after birth he went into heart failure and barely

Student nurse Becky Calhoun comforts a sick baby at Grant Memorial, where she helps out in summer.

At Grant Memorial, the pulse of activities (shown in the photographs on these pages) includes a hectic change of shifts, as day nurses take over from the night staff. One doctor says of the nurses, "We need the tops in the class. We have to rely on them to be able to do anything—because we are all alone out here."

A physical therapist, Tammy Evans works with a stroke patient to help him recover some movement. The hospital maintains a full-time physical therapy department and a fully stocked pharmacy. Many patients must come 60 miles on bad mountain roads. But, as one doctor points out, "Where else would they go?"

survived. Among other things, he was suffering from a malady doctors have dubbed "stiff lung"—the technical term is bronchopulmonary dysplasia—meaning that his lungs were unable to absorb oxygen. There is no known cure.

For five months the doctors and nurses in Morgantown kept Shane alive. They gave him oxygen through tubes in his nose; they fed him nourishment through tubes to his stomach. Then, with little hope for Shane's future, they sent him to Moorefield, where his 18-year-old mother worked in a chicken-processing plant.

Shane still required around-the-clock medical care. He ended up in Grant Memorial. "You should have seen him when we got him," says Linda Davis, director of nursing there. "It was pathetic. He just lay in his little crib without moving or making a sound. A baby at 6 months is supposed to laugh and cry, but Shane couldn't do either. Absolutely no facial expression: he didn't smile, he didn't frown. Then we discovered he couldn't suck very well, which meant we needed to feed him very often and in very small amounts. Believe me, Shane was one sad baby."

What happened next seemed entirely spontaneous and unrehearsed. "We sort of adopted him," Davis recalls. "We treated Shane like our own." The nurses gave him toys to play with; they clothed him in new, colorful nightgowns; they kept talking to him, cooing over him, picking him up and carrying him around.

As Cathy Crites, another nurse at the hospital, notes with severe approval, "That baby was spoiled rotten.

Richard J. Margolis is a freelance writer concerned about rural America. He wrote on volunteer fire departments in the November 1983 SMITHSONIAN.

Dr. L. R. Littleton reads x rays on visit to the hospital. He is licensed in 12 states and travels to small rural hospitals to render services as a radiologist wherever needed. A pathologist also comes to Grant Memorial regularly and technicians stay in touch with his laboratory by telephone.

Cathy Crites, R.N., inserts an intravenous tube into a 6-month-old baby, as Nurse Pat Shoemaker assists. Asked why she wears cap, Crites says, "In school we were taught to wear clean white shoes, white hose and a pressed, clean white uniform—and your *hat.* I worked really hard for this hat and I am proud of it."

When we had to do our charting at the desk, we took Shane with us and let him sit on our laps while we wrote out our reports. I don't think we hardly ever set him down."

In time Shane began to respond to all the attention. He learned how to laugh and cry. His new talents only increased the pampering. "Whenever he cried," says Crites, "one of us would pick him up right away. We were in terror he'd choke to death. Of course he caught on right away and he cried all the time. It was a kind of blackmail."

Shane also learned how to eat from a spoon, but only when the spoon was proffered by one of the full-time nurses familiar to him. "The part-timers never had much luck feeding him," Crites says. "But when one of us full-timers offers the spoon—Wow!"

On Shane's first birthday there was plenty to celebrate. He was six times his birth weight—he now weighed slightly more than 14 pounds—and most days he was able to breathe without benefit of oxygen tubes. At his birthday party, says Mary Beth Barr, the assistant director of nursing, "Shane giggled and ate cake with a spoon. We were so proud of him. He's such a *good boy.*"

I had set out to learn about small hospitals because I had heard they were an endangered species. I wanted to see what we as a nation stood to lose if we allowed these modest facilities, largely hidden from metropolitan eyes, to vanish. From a rural perspective, of course, such a loss would be catastrophic, not only in terms of the local residents' health (and the local economy) but also in terms of their pooled pride. For there is something about a small-town hospital that can inspire an altogether refreshing awareness of civic consequence. As a housewife who has lived all her life in Indepen-

Text continues on page 60

Rhythm of small-town life is apparent in the daily routine at Comfrey Hospital, as pictured in this series. The eight beds in this otherwise modern facility are still raised and lowered by hand crank. Here, Nurse Elaine Tindeland adjusts one carefully for a patient.

"We make everything from scratch here," says Bernetta Helget, who sets out her "delicious cookies" to cool.

Signe Quarnstrom donates 30 hand-sewn quilts to the hospital, as lap robes, in memory of her husband.

Dr. M. J. Rimas (Doc) and R.N. Shirley Christensen check patient, their expressions as healing as medicine.

Doc Rimas lifts 5-week-old Rachel, whose grandmother is a nurse here. Many of Doc's patients are friends.

A native Comfrey resident, Jerry Savage gets a shave and TLC from Nurse Elaine Tindeland. The nurses work long, hard hours, often staying into the next shift to help out. This day, when extra patient was admitted, a nurse said "Give her my dinner. I'll have some soup."

Comfrey nurse Diane Witt meets patient Leo Hoffman. Hospital has an outpatient clinic and provides social services as well. Following his visit, Hoffman remarked, "This is my home. These people are my family. If this hospital goes, next will be the school, then the town."

dence, Iowa (pop. 6,150), reminded me, "It's simply a matter of our self-respect. A town that loses its hospital has one less thing to be proud of."

Many small communities nowadays are having to face the indignities of subtraction. Of the 2,599 rural hospitals still extant—most with fewer than 100 beds—quite a few are verging on bankruptcy and each year some 40 are going belly-up. A study published recently by the U.S. Senate Special Committee on Aging predicts that over the next few years as many as 600 more will have to close their doors (80 in Texas alone).

Nobody knows for sure how to diagnose this disorder, much less what remedies to prescribe. While depressed rural economies are often a factor, the villain rural partisans most frequently single out, surprisingly, is none other than Medicare, the federal health insurance program for the elderly. In part, that is because Medicare reimburses rural hospitals at a substantially lower rate than it does urban hospitals. The difference has amounted to about 20 percent, and can go as high as 50 percent in some hospitals. In addition, Medicare's system of payments inadvertently penalizes small-town hospitality.

In the past, Medicare and hospitals had maintained a kind of gentleman's agreement whereby hospitals were trusted not to levy unreasonable charges for elderly-patient care. It was Medicare's custom to pay hospitals whatever amounts they requested, with little scrutiny. However, this blank-check approach to doing business probably encouraged considerable hospital inefficiency and avarice, in about equal parts.

Congress changed all that in 1983. Nowadays, instead of presenting a blank check, Medicare hazards a prediction of how long each patient is likely to be hospitalized, and then bases its payment strictly on that forecast. The new system may have saved taxpayers some dollars, but it has posed cruel dilemmas where patients require lengthier hospital stays than Medicare is prepared to compensate.

Such cases can be costly, which is why city hospitals rarely hesitate to discharge a patient who is no longer covered by Medicare. Quite a few rural hospitals, on the other hand, prefer to keep the patient and damn the expense.

The Henryetta Medical Center, a 52-bed facility in Henryetta, Oklahoma (pop. 6,290), is one of those. About three-fourths of its patients are insured by Medicare. In a three-month period, says James L. Clough, the former administrator there, "we lost nearly $80,000 on just six patients." Clough has meticulously described one of the six cases in a letter to Representative Mike Synar of Oklahoma.

An 80-year-old man dying of cancer was admitted to the hospital. His legs were paralyzed; he was in severe pain and required a morphine injection every four hours. As Clough tells it, "Attempts were made by the hospital and physician to place the patient in a skilled nursing facility located in Tulsa [47 miles away], but there were no beds available." The possibility of home care, with nursing visits, was also discussed. But it turned out that the man's wife couldn't provide, by herself, the care he needed throughout the day.

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Volunteer Evelyn Shobe, retired Petersburg beautician, visits monthly to do patients' hair, charging nothing.

Finally, Clough continues, "it was decided that the patient would have to stay at the hospital." He died there 68 days later. The hospital sent Medicare a bill for $26,660. Medicare sent back a check for $2,477 and marked it "Paid in Full."

Medicare rules aside, the simple dictates of neighborliness can play havoc with a small-town hospital's tight budget. In many such communities it is taken for granted that the poor no less than the affluent are entitled to medical care. To rewrite Robert Frost's famous dictum about home, a rural hospital is a place where, when you have to go there, they have to take you in. That is why village hospitals tend to donate more than their share of what health care commentators like to call "unreimbursed services."

At Grant Memorial I met an 88-year-old patient—the nurses called her "Miss Judy"—who had been there 48 days following gall bladder surgery. So far she'd run up a bill of more than $55,000, while Medicare's 15-day limit called for reimbursement of only $9,742. "She's got a daughter who works," explained Linda Davis. "How can we send her home when there's nobody to take care of her?"

A sign in the lobby of Grant Memorial tells the story: "Payment is expected when services are rendered unless other arrangements have been made in advance." In a region famous for poverty, those "other arrangements" can be costly to the hospital. "We don't turn anybody away," says Robert L. Harman, Grant Memorial's friendly, low-key administrator. "One way or another, we'll cover it."

Dr. John L. Hahn, the hospital's only obstetrician, told me that he delivers about 300 babies a year, and two-thirds of his patients are on Medicaid, the combined federal and state health insurance program for poor people. But Medicaid pays only about a third of Hahn's actual bill. "When somebody's down and out," he said, "I don't go after the rest of the money. I know what it's like to be poor." Then he added with a smile, "Don't advertise that."

"We did it because it was right"

People's Memorial Hospital in Independence, Iowa (20 miles east of Waterloo), nicely exemplifies this form of economic hospitality, so different from what patients experience in city hospitals. "When the farm crisis hit us a few years ago," recalls Robert J. Richard, the hospital's administrator, "we tried to make things easier for the families who were hurting most. Lots of them had no health insurance—the farmers could no longer afford it, and quite a few of the workers in plants around here got laid off, so they were unprotected, too. We made it a point to accept every patient who needed care. It cost us a bundle, maybe a quarter of a million dollars, but that was OK. We did it because it was right. We're very much a part of this farm community. Our social mission is paramount."

But, perhaps because this was Iowa, some proud patients inevitably objected to the hospital's generosity. "I don't mean to be disrespectful," an impoverished farmhand, the father of three small children, wrote to Richard after the hospital had written off a $380 charge for his daughter's stay there, "but I just can't understand how you could do what you did to me. I intend to pay you back every cent." And he did.

Administrators and board members who have been entrusted with the fate of their town's only hospital can be understandably pessimistic these days. In a recent national survey of hospital administrators taken by the accounting firm of Touche Ross, 48 percent of those heading small hospitals thought their institutions would fail in the next five years. On the other hand, hope in rural America really does spring eternal—the citizens there have no choice—and where there is hope, there may also be energy and imagination.

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Consider the case of the Central Valley Medical Center, a 30-bed hospital in Nephi, Utah. The dietitian there, along with her kitchen staff, had to be on hand even when there were only two or three patients to feed. So the hospital administrator, Mark Stoddard, put them to work baking birthday and wedding cakes (from scratch, of course), not to mention Christmas cookies and Valentine cupcakes, and selling them to local customers. The profits, about $3,000 a year, help to defray the hospital's food bill.

"We're trying to do everything we can to make ends meet," Stoddard says. To cut down on expenses, Nephi (pronounced "knee-fi") has taken a step that many independent-minded rural hospitals nowadays find distasteful but necessary. It has teamed up administratively with the hospital in Gunnison, 41 miles down the road. The two institutions buy supplies together, rely on some of the same specialists and use some of the same mobile equipment. Stoddard administers both.

Comfrey Hospital in southwestern Minnesota, which serves a farm community of some 1,800 people, has taken a similar step. The state's smallest hospital, it has joined with four others in the area to form a portion of Health Network of Minnesota, a coalition of hospitals in and around the southwestern part of the state. But in Comfrey's case the collaborative spirit may be turning sour.

"We're the underdog," says Gary Richter, the young editor-publisher of the *Comfrey Times*, "but we're going to fight the odds." The odds, according to an areawide study conducted by a Denver consulting firm, are not favorable. "There needs to be a reduction in the number of inpatient beds," the consultants concluded. They singled out Comfrey and nearby Mountain Lake as prime subtraction prospects.

But as Richter says, reflecting the peculiar cussedness of rural logic, "Those are just facts. You don't necessarily have to go with them."

A few days after the Denver report was made public, the townspeople decided not to go with the facts. At an emergency meeting, nearly everyone expressed an interest in "keeping the Comfrey Hospital going"; more surprising, a majority of residents favored the levying of a special hospital tax.

Rural Americans are not generally known for their spendthrift ways. When a group of small-town citizens eagerly volunteers to pay more taxes, they are sending a singular message about their beleaguered hospital: from where they sit, it is indispensable.

I learned more about the fierce local loyalties a hospital can engender when I returned to St. Andrews in Boothbay Harbor, Maine, thereby completing my rural round robin. Much had happened since our fortuitous visit 19 years ago. The old building, where Dr. Gregory had so deftly unraveled our son's distress, had become a 30-bed nursing home. Attached to it was a new, 22-bed acute care wing, built at a cost of $2.3 million and opened in August 1987.

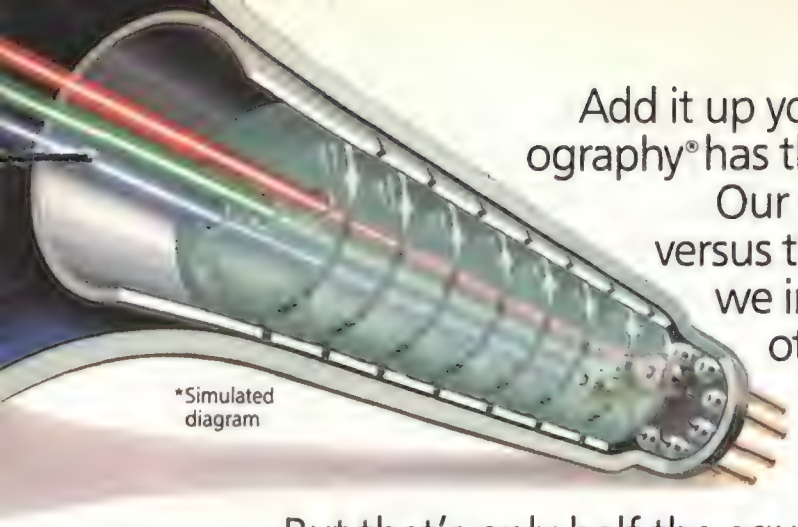
A hospital with familiar rural ailments

At first glance, all seemed well at St. Andrews. A second look, however, tended to darken the rosy picture. A few years back, I was told, the hospital began to be troubled by some familiar rural ailments. Its occupancy rate dropped to 28 percent. At one point the pinch was so bad that St. Andrews' staff, ever the cheerful givers, had consented to accepting a 20-percent cut in their pay.

Each year brought with it another discouraging deficit, and St. Andrews was driven to the very brink of ceding its cherished independence to a slightly larger hospital (27 beds) in Damariscotta, a town on the next peninsula, some 20 miles to the north.

But the merger plan was scuttled by aroused townspeople, and the harbor air has been calmer and

At Grant Memorial, Nurse Cathy Crites takes a moment to hug one of her patients. And they love her, too.



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In Comfrey hallway, patient works out with makeshift weight-and-pulley system, installed especially for him.

brighter ever since. Contributions from the residents, including a fair proportion of affluent summer people, had covered the new construction costs, so the hospital was free of debt. Last year, moreover, its 14-member unsalaried board of trustees had taken steps to firm up the hospital's administrative arrangements. They had signed a managerial contract with the Hospital Corporation of America, an international chain that owned 79 hospitals and managed 225 more. St. Andrews is doing better this year; it has recruited several more doctors to its ranks; and its occupancy rate has risen a notch. One trustee remarked recently, "For the crisis we went through, we're coming out of it not too badly."

I had been hoping on this visit to shake the talented hand of Dr. Gregory and to thank him once more for his ministrations to our son that strange summer night long ago. But I was told that Dr. Philip O. Gregory had died in 1983 at the age of 73. He was the son of St. Andrews' founder, Dr. George Gregory, a Nova Scotian who had migrated south in search of a viable practice. "Dr. George" opened St. Andrews on August 1, 1908, naming it for the patron saint of commercial fishermen. Large oil portraits of both father and son gaze down on the hospital's main corridor.

I spent the night at St. Andrews, not certain what I was waiting for. Nothing spectacular occurred—there were no emergencies—but in a small-town hospital, every night produces its own kind of quiet drama. Call it a theater of compassion.

The night's protagonist was Marilyn, a gaunt, middle-aged woman who had recently been operated on for gallstones. It was her third operation in ten months, so the nurses were not surprised when Marilyn started to hallucinate. "It's the anesthetic," explained Irene Fowle, one of the evening nurses. "It can cause a chemical imbalance. You have to take her seriously. She's really scared."

"An Indian" under Marilyn's bed

First Marilyn complained that the corridor was full of water, and the water was rising. "I can't swim," she confided to a nurse. Later she called for help because she had discovered "an Indian" under her bed. "What does he want with *me*?" she wanted to know.

As it happened, all beds were occupied that night and the nurses were kept busy. But to Marilyn they betrayed no sign of impatience. They answered her calls instantly, comforting her as best they could and pretending to look beneath her bed for hidden marauders.

When all else failed, a nurse's aide named Krista Greenleaf helped Marilyn don leather slippers and a flowered robe, and then walked her up and down the corridor, cooing to her as sweetly and soothingly as the

nurses in Petersburg had cooed to Shane. Eventually they made her comfortable at the nurses' station, tucking her into an enormous leather chair, with two pillows behind her head and a woolen blanket draped over her wispy figure. She sat there much of the night, scowling at me and the nurses. With her hair done in braids and her feet dangling several inches above the floor, she looked like a gray-haired child. "I'm frightened to death," she said to no one in particular. "I don't want to stay here and have everyone get hurt."

Krista Greenleaf spoon-fed Marilyn some medicine and hot tea from a plastic cup. "Hush," she said. "You stay right here with us. We need the company."

In the morning I had an appointment with Peggy Pinkham, the hospital's community relations director. "Would you like to see your son's records?" I was asked. The question surprised me. "Do you keep those things?" I asked in return.

Within minutes I was handed a stapled sheaf of papers. At the top of the first sheet someone had typed: "Name: Margolis, Master Philip E. Age: 12. Admitted: 8-29-70. Discharged: 8-30-70. Admission Diagnosis: Torsion (twisted) spermatic cord on the right."

Fascinated, I began turning pages. There were laboratory blood tests, temperature readings, blood pressure readings, three separate pulse notations and a comment on Phil's respiration ("normal"). At 10:15 that night Phil had "taken well" some soup, a sandwich and a glass of milk. About an hour later he "appeared to be sleeping." At midnight he was still "sleeping quietly." At 8 the next morning he seemed just fine. "Asymptomatic," someone had written on the chart. "No swelling."

What came over me as I read those precisely scribbled notations was a good deal of ex post facto gratitude. While Diane and I had slept in our vacation-cottage bed, there had been people three miles across the bay keeping wide awake. All night they paid strict attention to our son's health and comfort. It seemed to me he had been in the best of hands.

Partially paralyzed by an accident, a patient is given physical therapy for his hand by a visiting practitioner.

"For most illnesses," avows Doc Rimas, "you can get as good medical care here as you can anywhere."

STONEHENGE AND THE SPACE TELESCOPE

Over 4,100 years ago a Neolithic people built a remarkable monument on the Salisbury Plain in what is now southern England. As an engineering feat alone, Stonehenge stands as one of the wonders of the world. But a recent discovery has revealed that it served not only as a temple, but as an astronomical computer.

We know very little about the life of the people who built Stonehenge. But one thing that has become increasingly evident is that they were far more sophisticated than was previously believed. Even though they

worked only with Stone Age technology, they built a monument which apparently acted as an astronomical clock. With Stonehenge they could predict eclipses, the exact days of the solstices, the long-term cycles of the moon and sun, and other important heavenly events. They could begin to understand that the universe had order and how it worked.

The need to understand the workings of the universe is very ancient in man. One might even say that it is instinctual, that it is part of what makes us human.

A leap of forty-one centuries and we find ourselves still confronted with the same questions that drove the prehistoric Britons to build Stonehenge. How does the universe work? How did it begin? Will it ever end?

The Hubble Space Telescope will help us solve these primeval mysteries. Once in Earth orbit, the telescope will be able to detect objects as far as fourteen billion light-years away, which is to see fourteen billion years into the past; past the birth of the Earth; past the birth of our galaxy; to the very beginning of time.

The Space Telescope represents a momentous leap in the history of mankind. The builders of Stonehenge must have felt themselves on the verge of the same kind of moment as they discovered that creation actually had order. Within our own grasp is a view of the creation itself.

Lockheed
Giving shape to imagination.

By Constance A. Bond

A child prodigy from China wields a magical brush

Wang Yani began painting at the age of 2½; now 14, she is the youngest artist ever to have a one-person show at the Smithsonian

It was the 20th of June, 1989. During the preceding weeks, China had been in turmoil, tanks rumbling through the streets of Beijing, students massacred, the government locked in a power struggle. Now protest leaders were being rounded up for execution. These events lent an unreal quality to the visit of Wang Yani, a 14-year-old Chinese artist whose paintings resonate with freedom and spontaneity; such radically different, yet powerful, messages coming from China at the same time. In fact, until four days earlier it hadn't even been certain that Yani would be allowed to come. But here she was, and the only thing on the young girl's mind was making art.

Today she was giving a painting demonstration at the Arthur M. Sackler Gallery. Seated on risers in a small amphitheater were about 50 press people; in front, a wall of photographers jockeyed for position. The question was, how could she create anything in the presence of this menagerie?

With total concentration, that's how. Entering the room, barefoot and in denim shorts, Yani went right to work (p. 72). The 8-by-4-foot piece of paper on which she painted was placed on a low platform almost flush with the floor. Lithe and graceful, she moved rapidly between the paper and her collection of inks and paints. Loading her brush, she walked freely across the paper as though it were a stretch of sidewalk. It was only after applying the last stroke a half-hour later that she raised her eyes to the onlookers. (Later, asked how she was able to ignore the horde, she answered matter-of-factly, "They didn't help me, so I ignored them.")

At the press conference earlier that morning, Yani had moved to the front of the room to answer reporters' questions. She wore a classic preteen dress—short, flouncy, feminine. A strand of silver tinsel held her long hair away from her face. With her stood her father, Wang Shiqiang, and a woman, Liu Li Lundin, who acted as translator. Did she think, someone asked, that the political situation in China would affect her artistic career? No, she responded with a thoughtful shake of her head. Did she attend art classes at her school? No, she said softly, and a smile crept out. "I don't go to art classes at school. I once did a painting and the teacher criticized it. So I stopped going."

Although in this country she's just becoming known, Wang Yani has been recognized in China as a child prodigy for ten years. The first exhibition of her work was held in Shanghai when she was 4. By the time she was 6, shows had been held in Guangzhou, Beijing and Hong Kong. International recognition followed with

One of Yani's earliest works was *Kitty*, painted when she was only 3; until she was 6, she favored monkeys.

At 11, Yani painted *Last Night I Dreamt I Saw the Racing Egrets*, with this inscription: "Weaving in a pattern of black and white, the egrets moved in a great hurry. Last night's vision was still vivid in my mind, so I painted this especially."

Horses, a handscroll 13 feet long, was painted at age 8. One of her signature seals is at the lower left.

Unfazed by cameras, Yani paints at the Sackler Gallery; she gave her first demonstration at age 4.

exhibitions in Japan, West Germany and Great Britain. "Yani: The Brush of Innocence," which was organized by the Nelson-Atkins Museum of Art in Kansas City and supported by United Technologies Corporation, is now taking Yani's work across America. After closing at the Sackler on October 22, the show will move to the Nelson-Atkins (December 16-January 28, 1990) and then to the Asian Art Museum of San Francisco (March 7-April 29). Yani will return as the exhibition travels, and so far there is no indication that her trips will be canceled. At the Smithsonian, this is an unprecedented exhibition; Yani is the youngest artist ever to have a one-person show here.

When psychologists discuss child prodigies, they emphasize the necessity of talent, or "nature"; but they also emphasize the necessity of "nurture." In Yani's case, there has been an abundance of both. Born in 1975, she grew up in the small town of Gongcheng in Guangxi Province; nearby, the Li River meanders through the spectacular cone-shaped mountains of Guilin. The family's house is flanked by temples. In front there's a lotus pond; in back, a forested hill.

Yani's mother sells toys in a department store. Her father is an artist (he quit painting in 1983 so as not to affect Yani's artistic development). Her brother, 9-year-old Qiangyu, builds clay figures. "He's my closest friend," she told me in an interview; "we play on the mountain." Added her father, a calm, self-possessed man, "Yani's brother is very naughty, but he listens to her."

Constance Bond, a member of the Board of Editors, last wrote about the Henri Vever Collection, in January.

Although Yani paints energetically, once finished she deliberates a long time on where to place the seals.

Even as a baby, Yani loved to watch her father work in his studio. He used to take her for long walks in the woods and to the zoo, where she was enraptured by the monkeys, insisting she be allowed to get into the cage to play with them. As soon as she could hold a brush, she started painting monkeys and other animals.

Yani's earliest efforts were simply circles within circles, but she progressed rapidly. At 3, she painted *Kitty* (p. 70); at the age of 6, she produced the far more sophisticated roosters and monkey in *Don't Fight* (p. 74). She painted obsessively. "At bedtime, her mother would call, 'Yani, it's time to go to bed!' " her father says. "She'd always call back, 'Just one more.' " By the age of 6, she had painted 4,000 pictures.

When Yani was 4, a local art educator sent some of her works to an artist in Shanghai. Word came back: the artistic community there wanted to meet Yani. In Shanghai, she painted for more than 20 old masters. Never mind that they were nearly all elderly men and she was a 4-year-old girl. Recognizing her brilliance, they pushed for a one-person show.

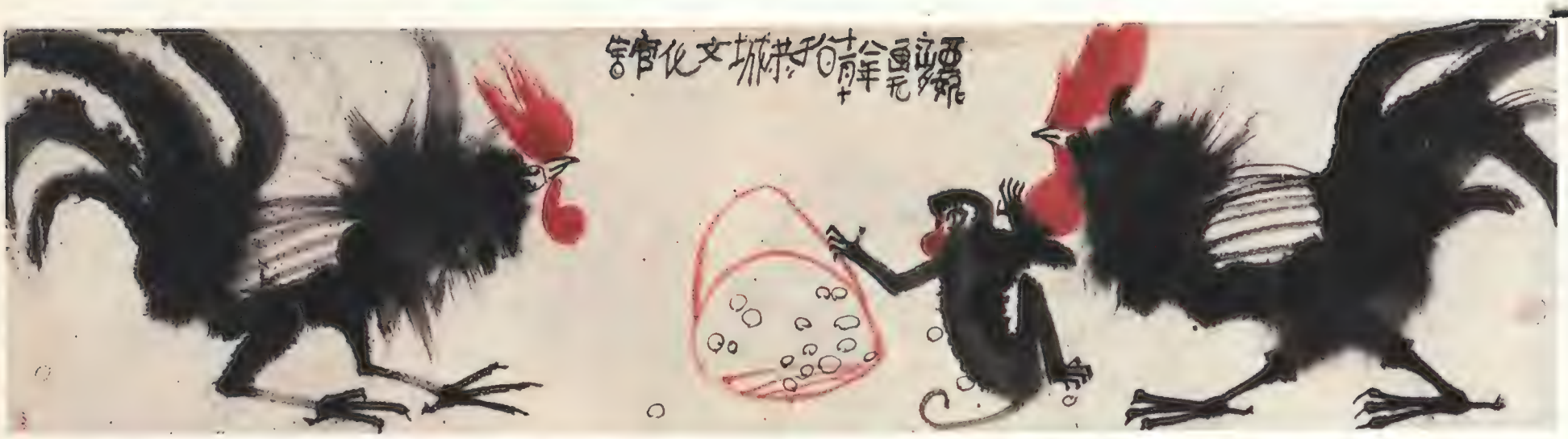
In a splendid essay in the exhibition catalog, Ohio State University art historian Julia F. Andrews explains why the artistic climate in China at that time was particularly opportune for Yani. The single largest trial that faced the artists of China in this century was the Cultural Revolution. From 1966 to 1976, the final decade of Mao Zedong's leadership, artistic freedom was ruthlessly suppressed in the name of "revolutionary culture." Artists who escaped labor camps were forced to paint in the approved propaganda style, turning out huge billboards extolling Mao's programs.

The Cultural Revolution ended with Mao's death in 1976, and each year after that artists in Shanghai and other cities tested the limits of official tolerance a little more boldly—particularly by mounting exhibitions of works that didn't conform to accepted guidelines. It was into this climate of cultural rebuilding and artistic excitement that Yani, who had been born one year before Mao's death, was welcomed.

Today, Yani is as prolific as ever, and the monkeys that she painted almost exclusively from the ages of 3 to 6 have been joined by a variety of other subjects. Her style of painting is popularly called *xieyi*, "idea writing," as distinguished from *gongbi*, or "skillful brush" painting. *Xieyi* is spontaneous; wet ink and pigment are freely mixed, producing rich overlapping and puddling; *gongbi* is a more controlled technique in which pigments are meticulously applied. In the late 19th century, a group of artists in Shanghai created bird and animal paintings in *xieyi*, and the modern tradition of this style can be traced back to them.

In an interview, Yani revealed much about how she thinks and creates art. As she, her father, Liu Li Lundin and I sat around a table talking, someone brought in a bowl of fresh strawberries. Before helping herself, Yani carefully selected one, placed it on a napkin and pushed it across to Lundin.

Yani listens to Beethoven ("loud") when she paints. ("Very loud," her father quipped.) Her favorite symphony, she said, was the one that begins "da da da duh" (Symphony No. 5 in C Minor). We moved on to other subjects, but throughout the course of the interview she softly hummed the four notes every minute or



In *Don't Fight*, which Yani painted at age 6, she shows herself as a monkey settling a quarrel, a role she often assumes when playing with neighborhood children in yard of family's home in Gongcheng.

so. Yani had the most to say when asked if she ever showed herself as a monkey in her paintings. "Yes; sometimes," was her answer. She included herself and her little brother, for example, in her scroll painting *One Hundred Monkeys*: "He likes to be tickled and so in that painting I'm tickling him."

By far the most interesting discussion was about *Don't Fight*. "Who is the monkey in this picture?" I asked, holding up a reproduction. She smiled and tapped her pinkie lightly on the tip of her nose a half-dozen times. Lundin laughed. "She says that is her." What's happening? "The two roosters are fighting over the rice in the basket. I'm telling them 'Stop now! Stop now!' I am just with some other children—the roosters are the neighbor children."

The neighbor children? "We often have many children playing in our front yard," she explained. "We play a game where we make a circle and pretend it's a house; it has a front door and a back door. Someone is assigned to guard the doors. And then we have a cat and a rat, and no one wants to be the rat. Sometimes there's quarreling about who has to be the rat. The rat goes in the front door, steals something to eat and runs out the back door. Then the cat chases it to get the food away."

She'd lost me. So, in your painting, does the circle stand for the house? I asked. "No, no; the circle is a basket of rice; the roosters are quarreling over it." Now I understood. When you play with your friends, I asked her, do you usually settle the quarrels? A smile spread slowly across her face as she listened to Liu Li Lundin repeat the question, and we all laughed.

I looked across the table at this marvelous kid, one of the most famous and celebrated young people in all of China. Well, I asked, how do you do it? Yani shrugged. "I tell them, all right, you be the cat this time, and the other person can be the cat next time—and I'll be the rat."

Yani captures the beauty of the Li River landscape near her home in *Spring*, painted when she was 9.

Fold out ⟶

Monkeys in *The Lion is Awake* (1983) are about to pay for their mischief. Yani's use of bold strokes to define form, as in the mane and body of the waking beast, is typical of the spontaneous *xieyi* painting style.

Overleaf: Detail from *A Hundred Monkeys* is part of a handscroll 35 feet long. Yani painted it at age 9.

五年元猴画九亚
日月五冬百岁妃

By James Trefil

Stop to consider the stones that fall from the sky

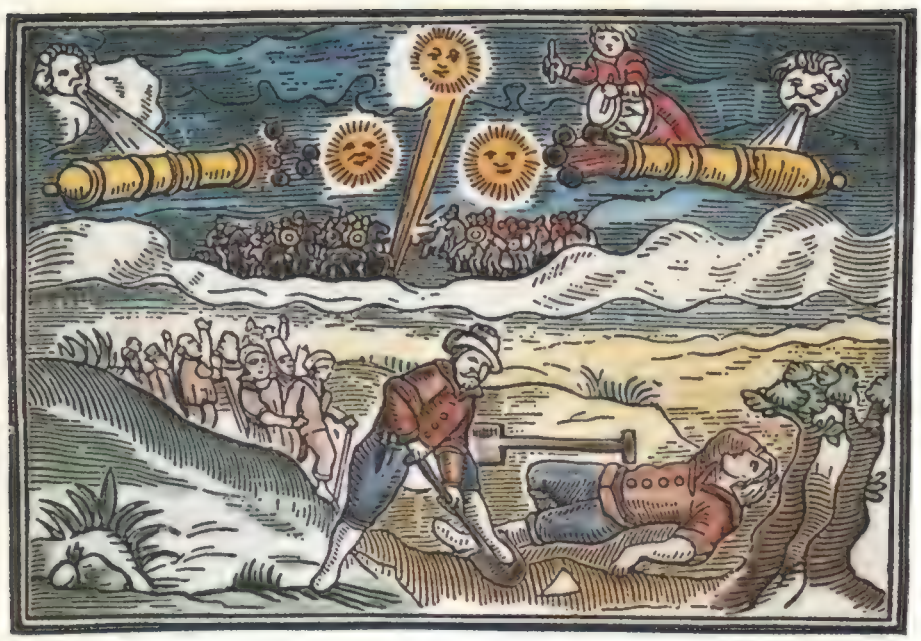
More often than we once thought, huge comets and asteroids strike Earth with catastrophic effect—a few months ago, one barely missed us

Astronomers saw it coming, but there was nothing anyone could do. Millions of miles away, a comet was streaking toward the Sun at 100,000 miles per hour. A dirty snowball 30 miles across, it was making its first pass through the Solar System. Against all odds, it was on a collision course with Earth.

All too soon, the dread moment came. The comet brushed aside the first tenuous wisps of atmosphere; its outer skin heated as the air thickened. So fast was it moving, however, that it scarcely slowed during the second or two it took to reach the ground.

Its tremendous momentum carried it several miles down into the rock. All of the energy accumulated during the thousands of years it had been falling toward the Sun was released as heat. With an energy equivalent to 100,000 times the entire nuclear arsenal of the human race, the comet exploded. Rock in the immediate vicinity was vaporized; that farther away was pulverized. A plume of debris was flung up at five times the speed of sound, heating the air over an area the size of Africa to 3,100 degrees F. Nitrogen and

Asked to show what would happen if a comet nucleus 30 miles in diameter hit Earth, the artist brought it down in northern New Jersey. This is the moment of impact. Everything visible, including the buildings of lower Manhattan in foregound, would be vaporized; plume of ejected material would soon cover globe.



Early version of aerial combat included cannon that bombarded Earth with meteors, in 1628 woodcut.

oxygen in the atmosphere combined to form a red smog of nitrogen oxides. In a few seconds a crater a hundred miles across had been blasted out.

Pulverized rock and dust continued out of the atmosphere and into space. There most of it was slowed by Earth's gravity and started to fall back in, creating the equivalent of an inch-thick layer of dust on top of the atmosphere all around the planet, blocking almost all the sunlight.

During the darkness, which lasted three months, the smog spread out from the impact site, blocking still more light. Within a year it had spread over the entire globe. Slowly the noxious cloud combined with water vapor to form nitric acid. The skies dripped acid rain, acid as strong as that in a car battery.

All this may sound like science fiction, but Ronald Prinn, professor of meteorology at the Massachusetts Institute of Technology, takes it very seriously. His computers spin out scenarios of what would happen to Earth if a giant comet or asteroid did hit. The doomsday story I've just told is the work of Prinn and his colleague Bruce Fegley; a worst-case scenario, to be sure, but a realistic one nevertheless. They suggest that scientists consider their acid rain theory as a possible cause for the mass extinction that took place 66 million years ago. "My problem isn't so much in killing things off," says Prinn, "but in finding ways for things to survive."

Prinn and Fegley are not dabbling in idle speculation. The kind of event they describe *can* happen; it has happened in the geologically recent past and it will happen again. Only in recent years have astronomers realized how often Earth is still being hit, and how certain is the probability that it will be hit again.

We have known for a long time that our planet is constantly being pelted with small particles, mostly the size of grains of sand and pebbles. We know that sometimes the projectiles are larger—the size of golf balls, bread boxes, even office desks. Twenty tons a day come filtering down through the atmosphere, the detritus of interplanetary space.

It has taken longer to realize that the heavy bombardment we associate with the early days of the Solar System, the barrage that left the surfaces of the Moon and Mercury so pocked, is still going on. But just last March an asteroid as much as a half-mile across, millions of tons of rock moving at 44,000 mph, shot by Earth at only twice the distance of the Moon.

If it had hit, according to Bevan French at NASA, the impact would have been equivalent to the explosion of 20,000 one-megaton hydrogen bombs, leaving a crater five to ten miles across and perhaps a mile deep. Known only as 1989FC, the asteroid orbits the Sun once a year in a regular elliptical orbit; it will be back. "Sooner or later," said its discoverer, Henry Holt of Northern Arizona University, "it will be drastically affected by Earth's gravitational well: either it will hit us, or Earth will sling it away."

No one saw it go by. Holt discovered the cosmic near miss when he looked at photographs (p. 92) taken March 31 with an 18-inch telescope on Palomar Mountain. Working backward in time after calculating the orbit, astronomers realized that 1989FC had crossed Earth's orbit on March 23. If Earth had happened to be at that point in its orbit on that day, the results would have been catastrophic. As it was, the asteroid missed us by only six hours.

We probably will not see the one with our name on it in any event. Asteroid hunters find their faint, fast-moving quarry by comparing photographs taken of the same sky field about 45 minutes apart. The asteroid stands out because it has moved in that time. But Carolyn Shoemaker (she and her husband, Eugene, make up one of the premier asteroid-hunting teams in this country) points out that one coming straight at us would not appear to move when the photographs were compared. It would most likely look like just another star, and would be ignored.

A half-dozen events in this century alone have made the astronomers nervous. Twenty-one years ago the asteroid Icarus sailed so close by Earth that, for the first time, scientists began to think seriously about sending up a rocket armed with thermonuclear weapons to nudge such an object into a new orbit. In 1937 Hermes missed us by about as much as 1989FC did. In 1932 Karl Reinmuth of Heidelberg discovered Apollo, the

A physicist at George Mason University, James Trefil works with paleontologists at the University of Chicago and hunts dinosaur fossils in Montana.

first Earth-crossing asteroid to be recognized as such and the one that gives its name to the whole family. And it was back in 1908 that an object the size of a small office building—probably an old comet—exploded near the Stony Tunguska River in Siberia with the force of 12 megatons of TNT.

Gene Shoemaker estimates that there are 1,500 asteroids and comets big enough to be measured in kilometers that could collide with Earth someday. Objects the size of mountains, moving at speeds measured in miles per second, are out there, crossing and recrossing Earth's orbit. Sooner or later, one of them and Earth will arrive at the same place at the same time.

Would two Yankee professors lie about it?

Meteors—those momentary streaks of light we see in the sky—have always been visible to humans. Today we know that each streak marks the death by incineration of a piece of rock usually no larger than a pea, a tiny cousin of Prinn's doomsday comet. But educated people did not always look at meteors this way. In 1718 Edmund Halley, the Astronomer Royal of Britain and no mean cometeer himself, explained a bright meteor that was seen over much of Europe as the ignition of certain "inflammable sulphereous Vapours" in the atmosphere. Even Thomas Jefferson was not immune to a bias against objects coming from space. Told that two professors from Yale had confirmed such an event, he is supposed to have remarked, "I would prefer to believe that two Yankee professors would lie rather than that stones could fall from heaven."

What seemed to be difficult for these men and their colleagues to accept was that the streak of light in the sky (a meteor) could turn into a stone on the ground (a meteorite). I would guess that this attitude was a holdover from the old idea that Earth was somehow special. To admit that rocks fell from the sky was to admit that Earth and the rest of the Universe formed a seamless web—that our planet is neither isolated nor special.

Two developments led to the acceptance of meteorites. One was the birth of modern chemistry in the late 18th century, and the consequent ability to analyze rocks that are supposed to have fallen from the sky and see whether they are different from their neighbors. The other was a spectacular and well-documented meteorite fall near the town of L'Aigle, in northern France, on April 26, 1803. A commission of the French Academy of Sciences quickly traveled to the site and confirmed that the stones were not terrestrial in origin. With this "smoking gun," the artificial division between Earth and the rest of the Solar System vanished.

During the 19th and early 20th centuries, meteorites were not only accepted but hunting them became a

Meteors sometimes fall in enormous numbers, as in this rendition of the night of November 13, 1833.

Ed McCain holds the meteorite that crashed through his garage roof and car in Benld, Illinois, in 1938.

Trees were leveled over 750 square miles when comet exploded above Siberia's Tunguska River in 1908.

A ring lake 40 miles in diameter marks the spot in Quebec where Earth was struck 212 million years ago.

scientific cottage industry (SMITHSONIAN, May 1980). The meteorite, with its tortured, burned skin, became a standard exhibit in the world's museums. While growing up in Chicago, I remember being tremendously impressed by a display showing a meteorite that had fallen through a garage roof, puncturing the top of a car and coming to rest in the seat. All the relevant pieces—the garage roof, the car roof, the seat and the stone—were there.

But for all this acceptance of the impact of extraterrestrial bodies on our planet, a curious kind of tunnel vision kept scientists' attention focused on small objects. There seemed to be no thought that if small bodies strike the Earth fairly often, the big ones—the sort that Ronald Prinn and Bruce Fegley's computer envisions—would hit occasionally, as well. And this meant that no one went out to look for the large craters that would have been left behind.

In 1891, for example, geologists first visited a place called Coon Butte (now better known as Barringer Crater or Meteor Crater) in Arizona, the archetype of the remains of an impact (p. 93). They concluded that the crater was caused by a steam explosion within the Earth—analogous to the bubbles that form when you heat thick oatmeal on a stove.

Throughout the first half of this century, geologists expended extraordinary efforts trying to explain away evidence that craters on Earth had been formed by impacts of extraterrestrial bodies. Campo del Cielo (Field of the Sky) in the Argentine pampas is a place where pieces of a meteorite created several holes in the

Harvey Harlow Nininger used a metal detector to find meteorite fragments.

Curator emeritus Edward Henderson (now 90) found these meteorites, today in the Smithsonian collection, in Australia's Wolf Creek Crater.

ground, some of them almost a hundred feet across, with the fragments of iron still lying at the bottom. A geologist studied the site and announced that prehistoric people had dug the pits to bury the iron!

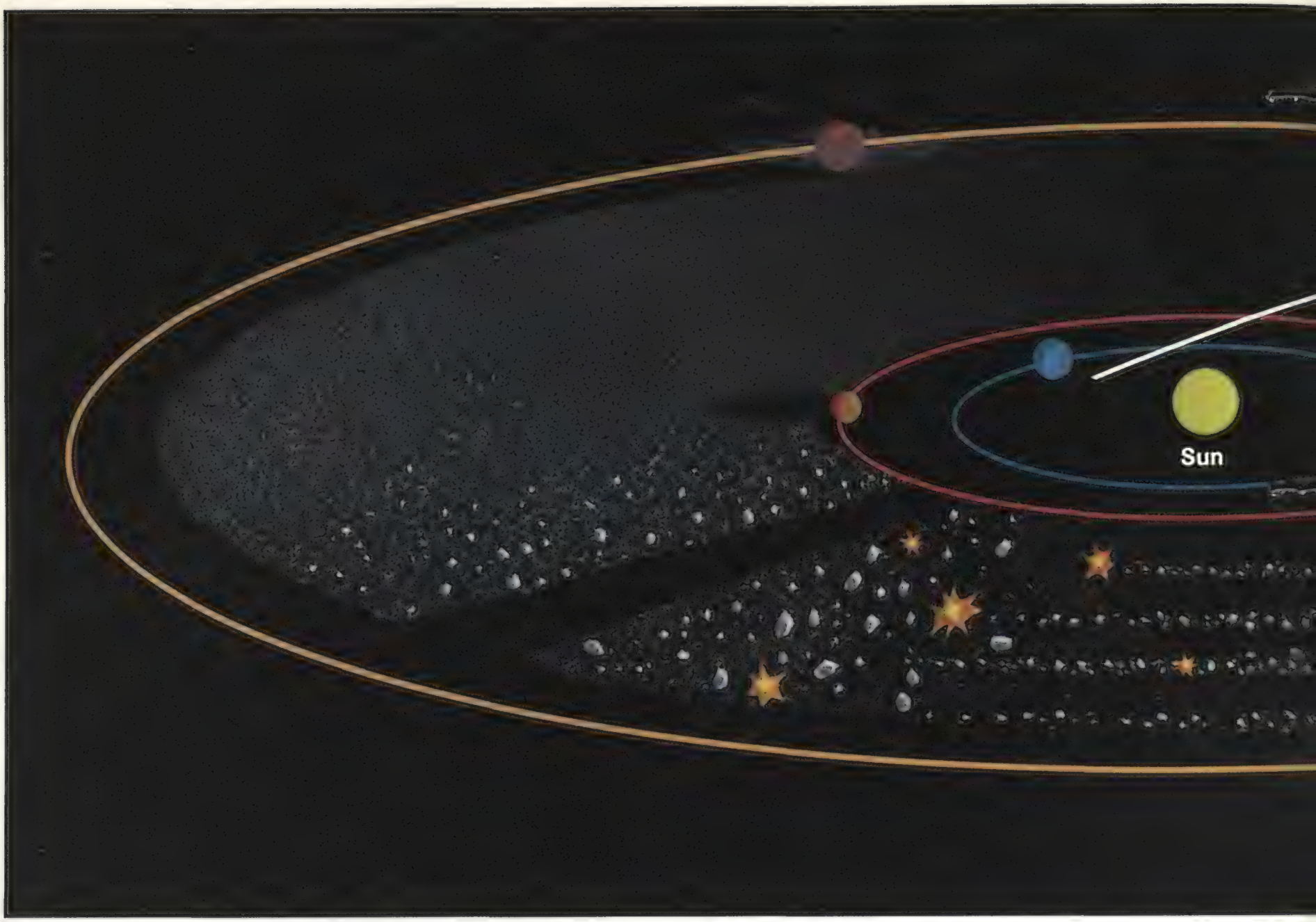
This uncompromising rejection of the presence of craters on Earth began to change with the work of Harvey Harlow Nininger. A teacher of biology and geology in Kansas in the 1920s, he was inspired by a meteor he saw in 1923 to set up a "meteor network" of newspaper editors, local officials and teachers around Kansas to report any meteoric material they found or, better yet, saw fall to the ground. While setting up this network, he found a place called the "meteorite farm" near Brenham. The owners kept plowing up bits of meteorites, which they sold to the curious and the scientific-minded. In a wheatfield on the farm, Nininger discovered a partially filled-in basin that the farmers called a "buffalo wallow" and recognized it immediately as a small crater. Subsequent excavation turned up chunks of what was undoubtedly meteoric material. Nininger had found a crater that had pieces of the meteorite that made it still inside.

Buoyed by his success, Nininger quit his teaching job and became a full-time meteorite hunter. He supported his family by selling specimens to museums and, eventually, by running a roadside meteorite museum in Flagstaff. He began his explorations of Meteor Crater by attaching a magnet to the end of a cane and walking around the crater area, picking up bits of iron from the ground. Later, he rigged a kind of magnetic rake he could tow behind his car to do the same thing. By the late 1940s he had collected enough fragments to convince scientists from the Smithsonian Astrophysical Observatory that the crater had indeed been caused by an impact explosion. They estimated that the original meteorite weighed more than 10,000 tons.

Despite this evidence, acceptance of the existence of large meteor craters on Earth was grudging. David Raup is now Sewell L. Avery Distinguished Service Professor of Geophysical Science at the University of Chicago, but he was a student in the 1950s. "We were still taught," he remembers, "that there were no meteorite craters on Earth, with one exception—the Meteor Crater in Arizona."

But sometimes you just have to believe the data. Aerial photography opened new vistas for earth scientists. Meteor Crater is less than a mile across, and it's easy for someone standing on the ground to see what it is. In a really big crater, though, one that is tens of miles across, this isn't true. You could stand in the middle of such a crater and see nothing except (perhaps) a ring of low hills—the crater's rim—in the distance. Big craters—the kind that Prinn's scenario would produce—can be seen in their entirety only from the air.

One early intimation of large craters came in 1951, when pilots taking aerial photographs of Algonquin Provincial Park in Ontario, Canada, noticed a curious feature near the town of Brent. The landforms—sides of two lakes as well as curved ridges—seemed to make up a huge ring about two miles across. Could this be



the remains of a crater three times larger than the one in Arizona?

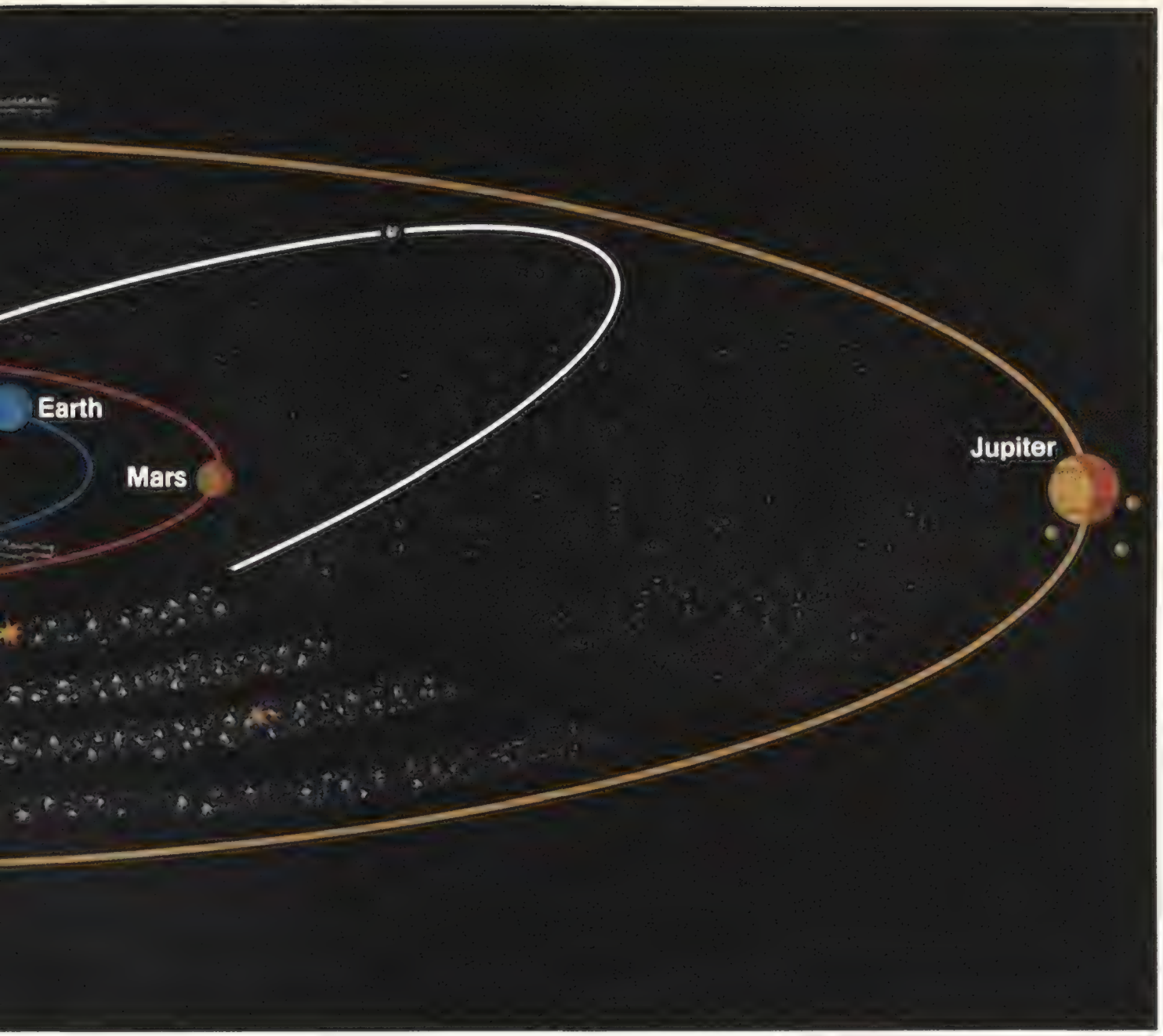
This question touches on an important aspect of craters on Earth. Unlike the Moon, where a crater will last billions of years, Earth's surface is a roiling, ever-changing environment. Over millions of years, mountain chains are raised and worn down, oceans appear and disappear. A crater created by an impact—even a crater many miles across—will be weathered down and changed over time. The challenge to geologists: recognize the remains of the crater even after eons of weathering.

To complicate matters, the existence of a circular structure in the ground isn't enough to prove that a meteorite landed. There are lots of ways to make circular structures—volcanoes, salt domes and sinkholes, to name a few. Over the years, scientists have learned to identify craters by looking at the rocks for evidence of the very high heats and pressure that have to be present when a large meteorite is stopped and explodes beneath the ground. This evidence can be in the form of minerals that can be created only at pressures much higher than those found in volcanoes, or in characteristic patterns of shattering in the rock.

There are many "craters" that have nothing to do with meteorites. Crater Lake in Oregon, for instance, is the filled-in cone of an old volcano. Another example is Hudson Bay in Canada. If you look at a map, you will see that its eastern edge is an almost perfect semicircle, a fact that led several scientists to suggest that the entire bay might be a crater. When no evidence for impact was found in the rocks, however, this notion was quietly dropped.

Once it was clear that a crater need not look like a crater, the search was on. Geologists pored over aerial and satellite photographs, searching for the telltale rings. When they appeared, an expedition to the site would be mounted and a search made for physical evidence of impact.

Gradually, the list of craters on Earth grew. Some of the entries are staggering. In northeastern Quebec, for example, is a ring of water inside a crater 60 miles across. Known as the Manicouagan Reservoir, this was the site where a meteoric object slammed into the ground more than 200 million years ago. In the intervening time, the rim of the crater has been worn away and the deep hole filled with sediments from the lake that formed in it. Today, all that's left of that cata-



In this schematic of the life cycle of the asteroid belt between Mars and Jupiter, time starts at the rear and runs counterclockwise. Spokelike gaps mark different eras. Though a planet never formed, material did coalesce into asteroids. These collided, often ending up as fragments again (left foreground). A few were kicked out into orbits (the white trajectory) that cross that of Earth. Streams of debris gradually organized themselves into orderly lanes. As time goes by, from right to rear again, remaining fragments will grind each other down into smaller bits of planetary scrap.

Map shows impact structures known as of May 31. None has so far been found beneath the world's oceans. Density is partly a function of where scientists have done the most work; more are found every year.

strophic event is the lake ring and, of course, the evidence in the rocks.

Nor is Earth's surface the only place that craters can be found. In the normal course of geological evolution, craters can be buried deep underground. Below the flat plains of the Williston Basin in western North Dakota, oil prospectors have found the remains of a crater almost two miles underground.

The larger craters were christened "astroblemes" (star wounds) by geologist and oceanographer Robert Dietz. Today the less imaginative but probably more accurate term "impact structure" is used, and the "keeper of the keys" is Richard Grieve of Canada's Department of Energy, Mines and Resources in Ottawa. He keeps an updated list of confirmed impact structures and publishes maps showing their locations (p. 87). We know of more than 120 scattered around the world, and the list grows by five or six every year.

Eugene and Carolyn Shoemaker use 18-inch Schmidt telescope at Palomar to search for new asteroids.

The stones in our museums, visitors from distant parts of the Solar System, carry information about conditions in places no human has yet visited. Two regions are sources for objects that eventually fall into Earth's atmosphere. One is the asteroid belt, a swarm of rocks circling the Sun out between Mars and Jupiter. Asteroids are the debris left behind by a planet that never managed to assemble itself. Occasionally a collision in the belt kicks an asteroid out of orbit, sending it toward the Sun. Such asteroids take up an orbit that brings them looping in past Earth on their way to the Sun: the Apollo objects.

The other source is the Oort Cloud, described by the Dutch astronomer Jan Oort in the 1950s. It is a region far outside the orbit of Pluto where comets—mixtures of rock and ice—orbit the Sun. Galactic tidal forces or jostling by passing stars occasionally send these into the inner Solar System, where the heat of the Sun vaporizes some of the frozen gases and produces the tail we associate with comets. Some comets pass through the Solar System once and are gone. Others, like Halley's Comet, get drawn in by the gravitational effects of the outer planets and settle into elliptical orbits. When the gases have all blown off after too many passes near the Sun, these comets, too, become Apollo objects. Scientists estimate that only a fraction of the Apollo objects got their start as comets.

Diamonds from before the Sun was born

By studying the pieces of this scrap pile that fall to Earth, scientists can learn much about how our planet and its neighbors formed. For Edward Anders, now professor of chemistry at the University of Chicago, studying meteorites was a case of love at first sight. "When I was a graduate student at Columbia, we had a lecture on meteorites and the speaker brought samples. Just holding a piece of extraterrestrial material was tremendously exciting. As soon as I could, I started to work on them."

Capping a long and distinguished career as an "astrogeochemist," Anders recently made one of the most exciting discoveries ever made about meteorites. He has isolated what he calls "pre-solar" diamonds—grains of material made by stars before the Sun existed and that were swept up into asteroids when the Solar System formed 4.6 billion years ago. He has also found pre-solar silicon carbide (he calls it a kind of "galactic garbage"), a mixture of grains from ten or more stars.

While chemists are using the record contained in small meteorites to unravel the origin of the Solar System, other scientists are using the craters to learn

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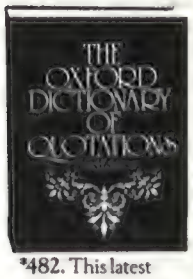

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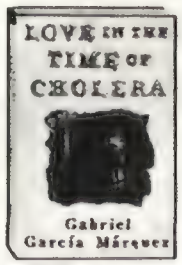

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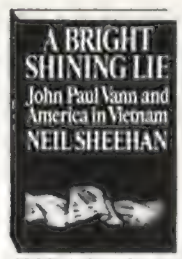

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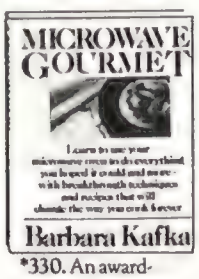

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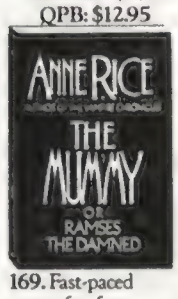

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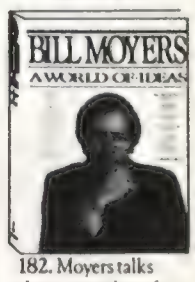

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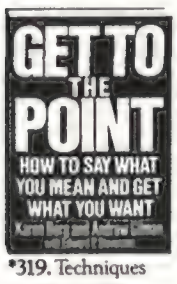

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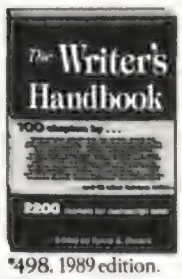

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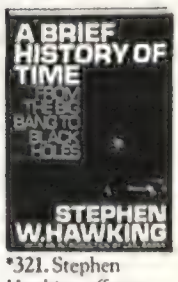

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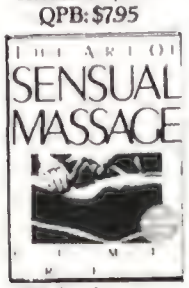

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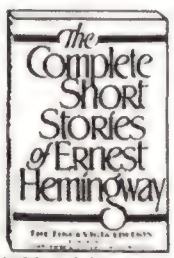

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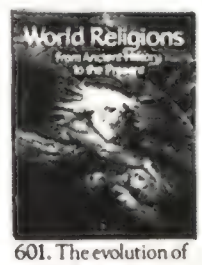

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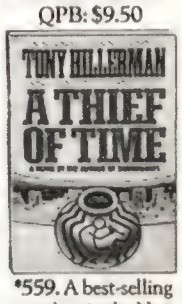

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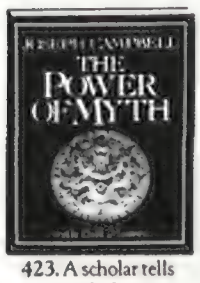

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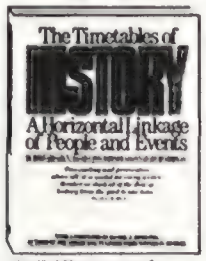

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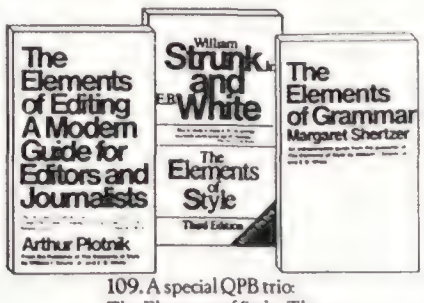
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Roy Lewis holds vial containing microscopic diamonds formed before Solar System itself came into being.

about the way life has evolved on our planet. The connection between craters and evolution has been made only recently. In 1980 a group from the University of California, Berkeley, published a bold thesis: at the same time that the dinosaurs were disappearing 66 million years ago, an asteroid about five miles across hit Earth. The group was headed by a father-and-son team: the late Luis Alvarez, a Nobel Prize-winning physicist, and his son Walter, a professor of geology (below).

They had discovered that the rocks that were forming at the time of the extinction contain unusual amounts of the element iridium. This platinumlike metal is rare at the surface of the Earth, but relatively more abundant in asteroids. Their interpretation of this result: an asteroid had hit Earth, raising a worldwide cloud of dust and blotting out the sunlight for three months, causing the demise of the dinosaurs and two-thirds of Earth's plant and animal species.

As more and more data came in, the Alvarez explanation gathered supporters. In the same places where iridium was concentrated, some investigators found shocked quartz, a mineral made only at high pressure. Others found traces of soot—evidence for worldwide forest fires caused by blazing fragments of the explosion falling back to Earth. And although scientists still heatedly debate the Alvarez hypothesis, it clearly remains one of the major contenders for the explanation of the dinosaurs' extinction.

But there is one problem with this theory: we cannot unambiguously identify the crater made by the asteroid. Some geologists have looked at the quartz that was shocked when the asteroid hit and, by plotting on a map the areas where the degree of shock is the same, have produced a series of concentric circles whose center is supposed to be the site of the crater. When this is done (and allowance made for the motion of the continents in the past 65 million years), the best candidate lies near the town of Manson, Iowa. There, buried under a few hundred feet of rubble left by the last glacier, lies a crater 25 miles across and known to us from cores brought up from boreholes. This structure may be the signature of the impact that caused the most famous of the mass extinctions.

While the brouhaha over the Alvarez hypothesis escalated, NASA beefed up its investment in the ongoing search for asteroids. Scanning the skies for small, quick-moving objects, scientists are turning up several new Apollo asteroids each year.

Among the most interesting people involved in this research are Eugene and Carolyn Shoemaker. Eugene works for the U.S. Geological Survey in Flagstaff. Trained as a field geologist, back in the 1950s he was one of the pioneers in recognizing the widespread presence of meteorite craters. Over the past several years, he and Carolyn have spent months tramping around the Australian outback, adding substantially to the list of known craters. Today, they make several trips a year to Palomar Observatory where they use the 18-inch telescope to photograph the skies in their search for new asteroids. As a side effect of this search, Carolyn has become something of a celebrity among astronomers: she found no fewer than five comets during one incredible eight-month period in 1984. "Astronomers have essentially abandoned the Solar System," says Eugene, referring to the current concentration on distant galaxies and cosmology, "so the geologists came along and adopted the orphan."

The late Luis Alvarez, a physicist, and his geologist son Walter examine a clue to the dinosaurs' demise.

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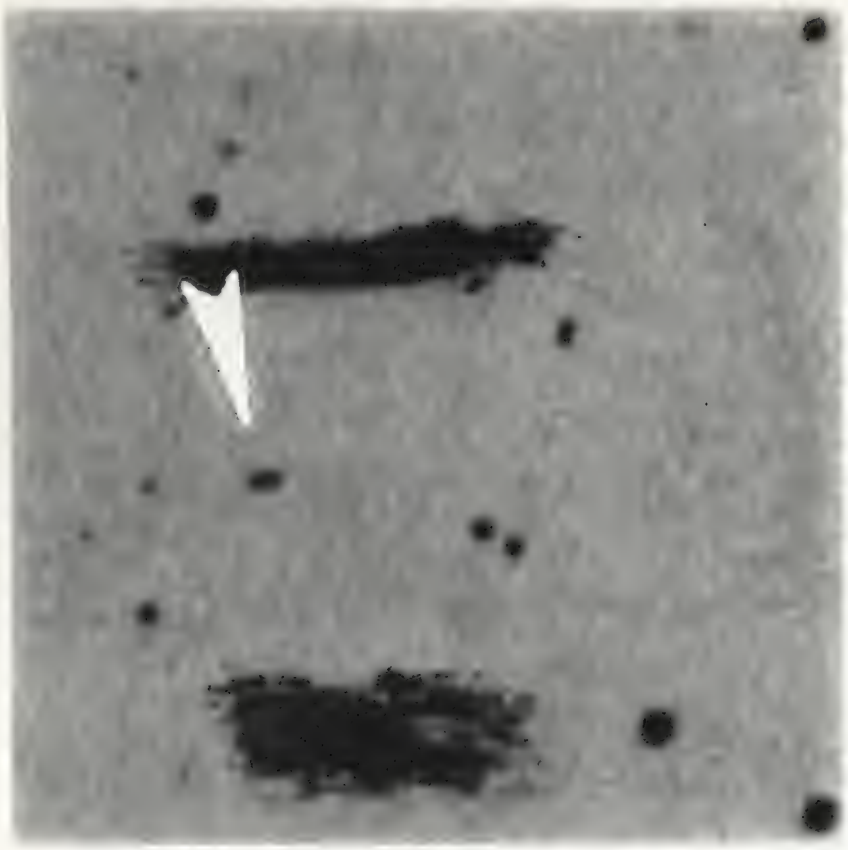
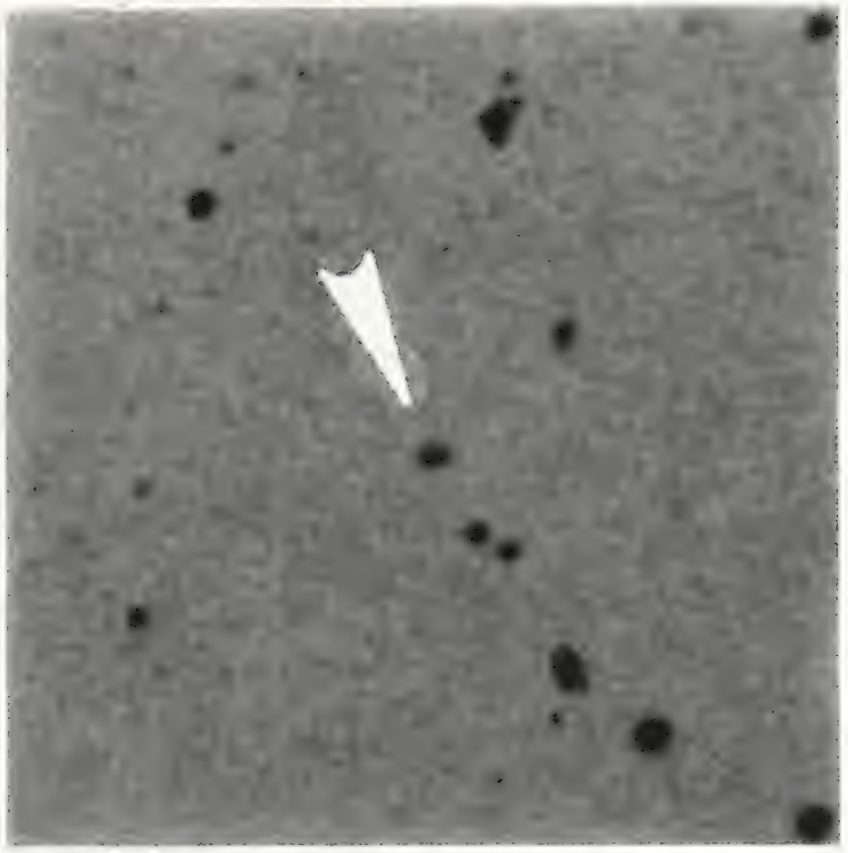


Pictures taken 50 minutes apart show the motion of the asteroid (arrows) that passed close last March.



Discovery came only days later. Irregular bands on left image and stray dots are from marking pens.

The mass extinction 66 million years ago could well have been caused by the impact of an Earth-crossing asteroid of the type the Shoemakers are discovering. If this were the end of the story, it would be interesting enough, but it would not change the current view of evolution. After all, there are bound to have been occasional large-scale accidents in Earth's history. What really has the community of evolutionary scientists excited is a paper published in 1983 by David Raup and Jack Sepkoski of the University of Chicago. Paleontologists have long known that there have been many mass extinctions during the past 700 million years; the disappearance of the dinosaurs is neither the largest nor the most recent. What Raup and Sepkoski discovered about the ten such events during the past few hundred million years is that they seemed to occur regularly, about every 26 million years.

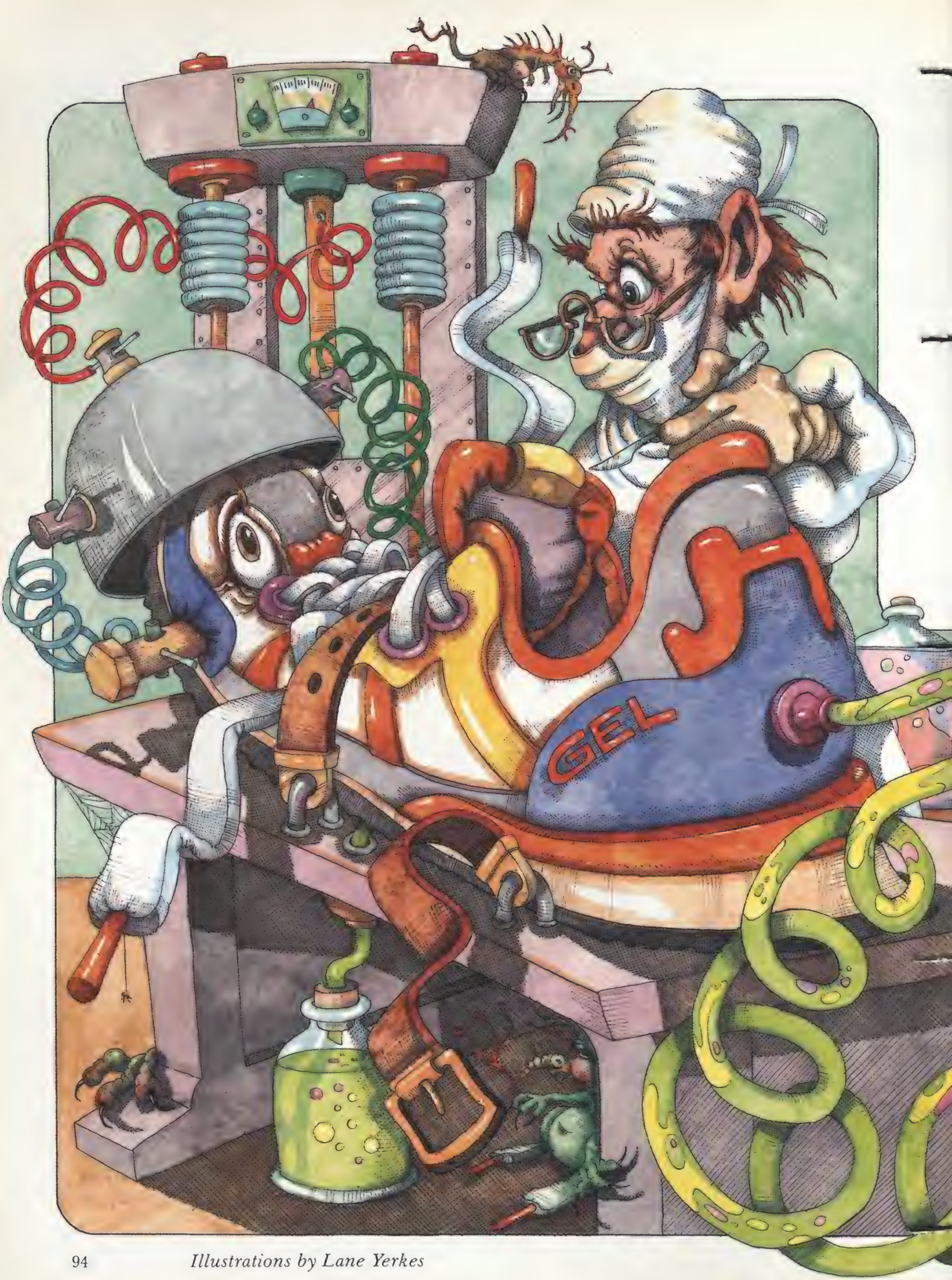
This totally unexpected conclusion is still being debated, but it leads to very interesting questions. If the dinosaurs' extinction was caused by an asteroid impact, and if that extinction was just one of a regularly repeating series, could it be that every mass extinction was caused by such an impact? Could it be, in other words, that every 26 million years a mountain-size rock falls from the sky and clears the deck among Earth's life forms?

Astronomers who think about such questions have hypothesized that there are ways that such periodic bombardments could arise. The Sun, in its journey around the galaxy, for example, passes through the cluttered central plane every 26 million years. This passage could jostle the Oort cloud and send a storm of comets raging into the inner Solar System. Others have suggested that there is a hitherto undiscovered dark companion to the Sun, which was quickly nicknamed Nemesis, that comes near the Oort Cloud every 26 million years, triggering the storm.

If this conjectured cycle of destruction proves to be true, it will revolutionize the way we think about the development of life on our planet. Instead of the slow, steady replacement of one species by another, as Darwin envisioned, we would have instead a situation in which the Darwinian progression goes on for 26 million years—and then a catastrophic collision occurs, wiping out a good fraction of the species that have evolved during that time, and the whole game starts all over again.

A few scientists have even suggested that the extinction that may have been caused by the Manson asteroid (that of the dinosaurs and their cousins) cleared the way for the rise of the mammals. If it were not for asteroids bringing death and destruction to Earth, in other words, you might be reading this magazine while switching your long, green tail and admiring your bright, shiny scales.

Only about 50,000 years old, Meteor Crater in Arizona may be our planet's most familiar impact structure.



Illustrations by Lane Yerkes

By Richard Wolkomir

The race to make a 'perfect' shoe starts in the laboratory

'Energy-return' systems, computerized heels, 'tri-density' midsoles, 'nitrogen microballoons': where will the running-shoe revolution end?

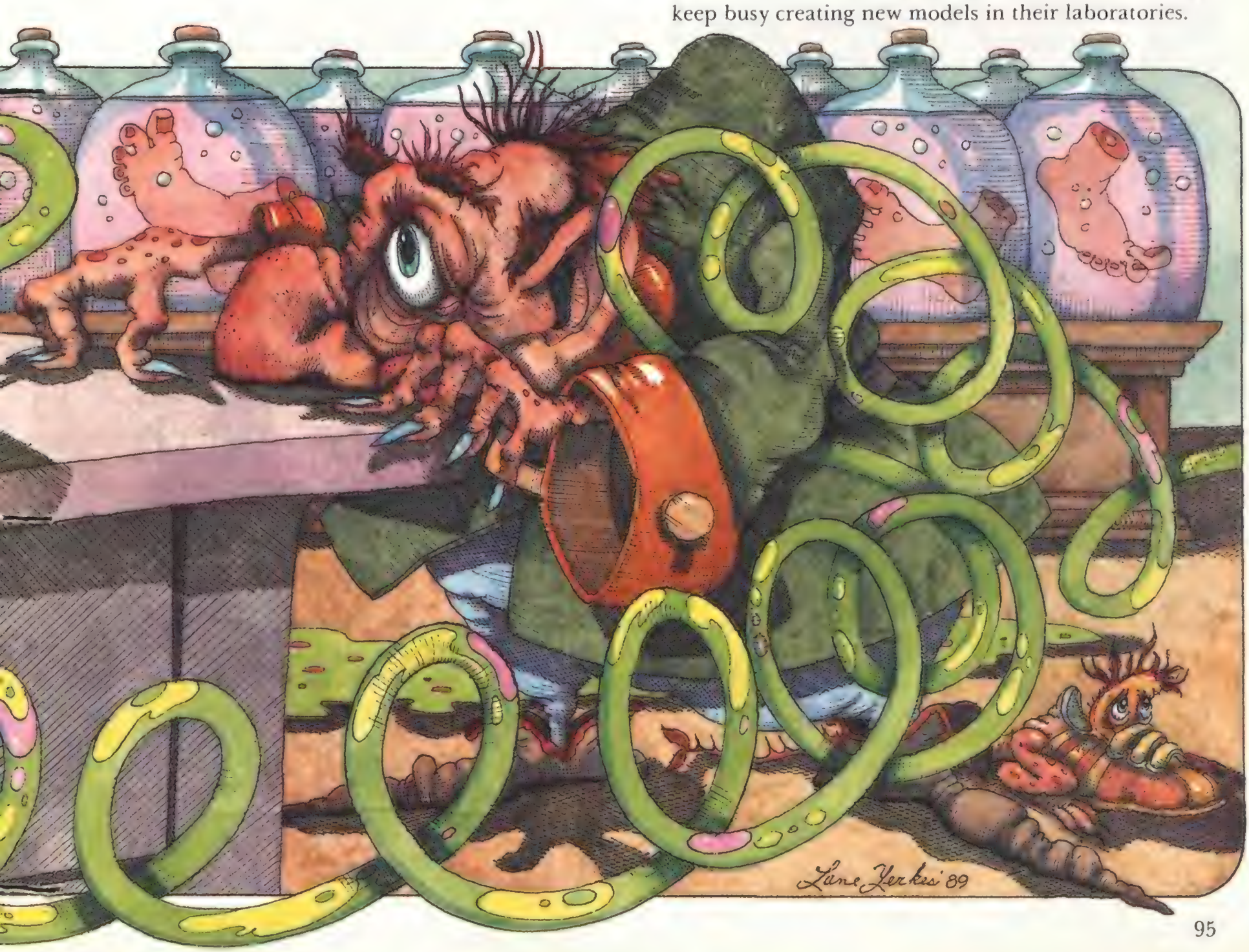
Before we take up the issue at hand, the technological beatification of the humble sneaker, let us remember: it is merely a shoe.

Sure, it was designed by PhDs in white coats. And it's true that their labs do blind and buzz with advanced electronics. Their computerized sensors, for instance, can calibrate the kinetic forces James Worthy exerts on his hightops hitting the floor after a jump shot, and show them as a colored topographical map of valleys and peaks, like the Himalaya.

And, yes, I have talked with researchers so committed to analyzing runners' problems that they were willing to have pins inserted into their knees. Then they ran on level ground wearing off-kilter shoes while cameras recorded the actions of the pins to see how their locomotion was affected.

We are talking here about a $3 billion annual expenditure (in this country alone) for athletic shoes, which have become so high-tech you can hardly appreciate them without an understanding of calculus. We now traverse supermarkets in models with features that

Researchers on the cutting edge of sports-shoe design keep busy creating new models in their laboratories.



In Vermont's annual Rotten Sneaker Contest, a coach wearing a gas mask judges entries according to odor.

sound appropriate for the space shuttle, like ASICS' "vertical extension midsole collar and extended stabilizing pillar" and Turntec's "ZO" system, which combines an "anatomical cradle" with "high-energy rubber inserts in a composite module." But, really, they're just shoes. And, like any other shoes, they're mortal.

In Vermont, dedicated wearers of athletic shoes celebrate that mortality every March with the Rotten Sneaker Contest. A local sports store began the event 13 years ago, at the height of the running boom, but now it's sponsored by the company that makes Odor-Eaters, a foam shoe insert. And the competition has gone international.

This year's contest, in a gym in the state's capital, drew competitors from as far off as Indiana, Texas, Puerto Rico and Ontario, all claiming to own the world's deadest sneakers, based on expert assessments of the putrefaction of sole, tongue, eyelets and heel, and overall lack of esthetics. An evaluation of the shoes' odor was made by a local basketball coach wearing a modified gas mask. Judges used tongs to handle and inspect the entries, which were in various stages of decomposition. This year's champ, a first-grader from Barre, Vermont, said the secret of producing shabby-looking sneakers is to "drag 'em."

There's a shoe for every purpose

It is a salubrious rite because some of us runners have gotten much too serious about our sneakers. This fact was brought home to me during a recent visit by my mother. She opened my closet to use the mirror behind the door and let out a faint gasp. I found her staring transfixed at my athletic shoes jumbled all over the floor, including these:

- A pair of tan Nike Daybreaks, battered but retained for nostalgia because I ran my fastest six miles in them. Still good for mowing the lawn.
- Three pairs of blue-and-gray New Balance running shoes, models 565, 570 and 575, retired from active duty because they have too many antipronation devices for my feet, but great for walking around.
- A pair of silver-and-gray Adidas Questars, with soles that proved too stiff for my arches.
- A pair of tattered Nike Air Pegasus running shoes. They are equipped with little balloons in their soles to absorb shocks.
- A pair of Saucony Azura STs, for speed work. They're lightweight, with an "energy-return" system.
- A pair of Reebok World Trainers, red, white and powder blue, for easy "conversation" runs with friends.
- A pair of featherweight New Balance 830s, still unused, acquired with high hopes for establishing new "personal best" speed records.
- As well as Avia tennis shoes, Rockport walking shoes

and a pair of jet-black Reebok cross-trainers, which I like to use for a variety of sports.

"Why do you need so many shoes?" my mother exclaimed. "This looks like Imelda Marcos' closet!"

I was speechless. How, after all, do you tell a member of the Keds generation about that peculiar modern quest, the search for the perfect athletic shoe? Until the 1970s, when running fever hit, shoes might be cheap or costly, decorative or utilitarian, but they weren't *engineered*, like B-1 bombers.

Today's sneaker has built-in braces to prevent pronation or supination, anatomically correct arch supports, soles designed to roll the foot just far enough, and special cushioning for the foot's heel and ball. You can buy shoes specifically engineered for the stops and pivots of specific sports—handball, squash, tennis, basketball. Some shoes put gas capsules under your feet. Or tubes of gel. Saucony's Courageous line promises a "tri-density compression plug midsole, with increasing EVA foam densities across the rearfoot and midfoot region." Looming just over the horizon: inflatable shoes for a really snug fit.

Money is no object. I recently visited a marathoner in her 50s who showed me her closets. Lined up in phalanxes were more than a hundred pairs of Nikes and Tigers, in various stages of senescence. At $40-160 per pair, sneakers are an investment and if you're getting into this market you need guidance from a trained financial planner. But every season, new models pop up with alluring improvements, and we fitness activists contend that fiscal excess in pursuit of ambulatory excellence is no vice.

In my own quest for a footwear Ferrari, I've been talking to researchers at shoe labs operated by universities, and companies like Reebok, Converse and Nike. I've been watching scientists in white coats ram pistons into new sole materials and monitor computer readouts while wired-up volunteers dash across force-measuring plates embedded in the floor. Not altogether surprising, the experts are discovering that the most important thing about running, jumping and other forms of energetic locomotion is not the shoe but what's *in* it: the foot.

Each of your legs has 30 bones. Each foot has 26 bones. Tendons link bones to muscles. Ligaments bind bone to bone, at the joints. And the whole muscle-gristle contraption acts as a spring, storing and releasing energy as you walk or run. At Britain's University of Leeds, zoologist R. McNeill Alexander conducts basic research on locomotion. He tests tendons from kangaroos and dolphins in calibrated pulling machines, and also feet donated by amputees. Alexander has found that 93 percent of the energy used to stretch a tendon is returned when it is released. It is like stretching a rubber band, then letting it snap back. He points out, furthermore, that the Romans powered their rock-heaving catapults with the twisted tendons of cattle and horses.

Alexander has identified three energy-storing mechanisms in the human foot. First is the Achilles tendon, connecting your heel to your calf muscles. It stretches when you step down (storing energy) and relaxes when you step off (releasing energy). This gives your foot built-in bounce. Your foot's arch works the same way. It flattens when you step down, stretching its ligaments.

She opened the door. gasping. "Why do you need so many shoes? This looks like Imelda Marcos' closet!"

By the time he finally locates the perfect pair of running shoes, Mr. Wolkomir fears he'll be such an imperfect runner he won't need them.

Though today's sneakers are designed specifically for sports, most are purchased strictly for casual wear.

When you step off again, it relaxes, thereby releasing its stored energy. Finally, under your heel bones is a fatty cushion. Alexander found out that this pad does not provide extra oomph on lift-off; instead it acts as a shock absorber.

Ironically, many running shoes tend to deaden the foot's natural bounce. Apparently our ancestors knew that, since competitors in the first Olympics in 776 B.C. ran barefoot. Nevertheless, early in history humanity traded springiness for protection against stones and cold mud. The earliest known shoes were sandals. A pair found in Egypt, made of braided papyrus, dates back 4,000 years.

Eventually our fashion-conscious race discovered the panache of fancier footwear. The practical Romans, for instance, invented shoes shaped separately for left feet and right feet. But they succumbed to the urge to prettify: Roman aristocrats sported sandals with ermines' heads at their ankles. Hellenistic Greek women wore luxurious soft shoes (the hot colors were white or red). By medieval times the rage in Europe was shoes with toes so long and floppy the chic suzerain had to hold them up with cords tied to his knees. In the 1480s the style was a shoe six inches wide and shaped like a duck's bill. Fashionable Venetian ladies clomped about on shoes fixed to stiltlike wooden blocks, up to a foot and a half high. Later, boots came into vogue, sometimes fitted so tightly a courtier might have to soak his legs in cold water to shrink them before he could pull his boots on.

From sandals to pumps to plimsolls

Shoes worn by the Roman army's message runners were typical of early sports shoes—heavy-duty sandals, with hobnails for traction. By the 16th century, slipperlike "pumps" were popular for games. Spiked shoes for cricket and running appeared in England in the 1860s. Lighter in weight would be canvas plimsolls, circled by a decorative band of rubber and named for the British politician who had load lines painted on ship hulls.

Later, plimsolls acquired rubber-slab soles and evolved into sneakers. They were fine for croquet, but the gum rubbers of the day wore out too quickly for the shoes to catch on for serious sports. Meanwhile, marathon fever gripped Britain and the United States, including 500-mile-plus "pedestrian races" lasting six days. For shoe companies, all those sore feet should have been a bonanza, but the era's technology wasn't up to it. A. G. Spalding's 1894 catalog offered sprinters three grades of lightweight kangaroo-leather spiked shoes (ranging in price from $3 to $6), with spike variations for jumping and walking. But distance runners still wore bulky shoes with stiff leather soles. At the 1904 Olympic marathon in St. Louis, an American

Until the 1970s, when the running fever hit, shoes for athletics might be cheap or expensive, decorative or utilitarian, but they were not engineered like the B-1 bomber. Now new models keep popping up every season featuring the very latest design innovations.

runner wearing such shoes, Fred Lorz, amazed reporters by running back into the stadium "almost as fresh as when he left it, over two and a half hours earlier." However, it later turned out that his footwear was not the reason. Lorz had ridden part of the way back to the stadium in a car.

With shoes like that, who could blame him? In 1909, Spalding introduced a shoe coated with rubber "to prevent slipping and straining of the tendons or muscles," but each shoe weighed about a pound. As late as the 1920s, one runner religiously soaked his feet in brine before races in order to toughen them for the rigors of his shoes.

At the 1936 Olympics, Jesse Owens earned at least one of his four gold medals wearing relatively lightweight new shoes made by an athletic cobbler named Adi Dassler, from Herzogenaurach, in western Germany. By 1948, Dassler's company, Adidas, was experimenting with even-lighter training shoes, made from war-surplus tent canvas and fuel-tank rubber.

Others, too, were groping toward better track shoes. In 1951, for instance, Japan's Tiger company tried to sell a shoe with a separate compartment for the big toe, like a mitten's thumb. Then, in 1962, a Boston orthopedic-shoe manufacturer, New Balance, produced the first modern track shoe, the Trackster. Instead of a nailed-on heel (like a dress shoe), which increases pressure on the forefoot, it had a sneakerlike toe-to-heel "ripple" sole. But a heel does not relieve strain on the Achilles tendon, and so New Balance tucked a rubber wedge under the Trackster's stern, between the upper and the sole. The wedge, which also helped absorb shocks, quickly became standard on running shoes.

Meanwhile, at the University of Oregon in Eugene, track coach Bill Bowerman was so disgusted with the footwear then available for his runners that he learned to cobble shoes himself. Working with Tiger, in 1967 he produced a running shoe with an upper made of nylon, instead of leather. Nylon was tough, lightweight and better ventilated. Then Bowerman experimentally poured urethane onto his wife's waffle iron and invented the "waffle sole," a lightweight tread with good traction.

Bowerman and some friends formed the Nike company. It ballooned from a basement hobby in the early '70s into today's billion-dollar sneaker superpower because the founders heard a marathoner complain that his shoes had too little cushioning. That gave them a bright idea. They stripped off a running shoe's "outsole," the layer of treaded rubber that hits the macadam. In its place, they stuck on a Japanese shower slipper from a drugstore. Then they created a new outsole by coating the bottom with rubber. They had invented the padded "midsole." For runners, it was a historic moment.

When I began running in the 1970s, I pounded around the track in the kind of slab-soled sneakers I'd worn since childhood for everything from after-school football games to walking to the movies. But my feet hurt. A friend urged me to try shoes designed for running, so I bought a pair of Nikes. I was skeptical but when I put on those shoes and started to run, I seemed to float around the track on a cloud. Actually, I was floating on midsoles. That layer of padding quickly became a marketing war zone.

At first, midsoles were made of rubber. But in 1974 engineers came up with a lighter, more-cushioned ma-

terial: ethylene vinyl acetate, or EVA. It is a foam—a plastic full of gas bubbles. It is lighter than rubber and a better shock absorber. The athletic-shoe horsepower race was under way.

In the new shoe labs, researchers discovered that the normal running foot strikes the ground on the heel's outside edge. Then it rolls inward, finishing with the weight on the inside edge of the forefoot. During that inward roll, called pronation, the arch flattens as it absorbs the shock of the foot strike. But many feet overpronate: they roll too far, which can injure the foot, ankle or knee.

"Motion control" became the new buzzword. Shoes sprouted antipronation devices, like the cuplike plastic "heel counter" and the wraparound plastic strap called an "external stabilizer." There was also the "varus wedge," which tilts up the inside edge of a runner's heel to counter the foot's inclination to overpronate, an idea first tried in Army boots in 1958. Then designers discovered they could temper overpronation by stiffening the midsole toward the shoe's inner edge.

By the mid-'80s, designers had pronation corralled. Panic swept the executive suites. As Rick Mochen, manager of industrial design and technical development for the Etonic company, puts it: "If you sit still in this business, you get blown away." That was when athletic-shoe companies discovered walking, a new arena for technological enhancement. Walking is not exactly a new activity, but this is "power walking," a phenomenon peculiar to our times.

Someday, after a run, you'll plug your electronic shoe into a computer to get time, distance and heart rate.

For walkers and runners, different locomotion

Walking, in case you haven't noticed, is much different from running. When you step off walking, you push to the side as well as forward, moving your center of gravity over the supported foot. Hence, walkers sway from side to side at the same time that they are moving forward. Runners, instead of moving their body over their planted foot, tend to keep themselves centered and swing each leg more directly underneath. A walker on a beach typically leaves two lines of tracks; a runner is more likely to leave only one line.

"In walking, the foot's motion is a slow roll onto the toes," says cardiologist James Rippe, director of the University of Massachusetts Medical School's Exercise Physiology and Nutrition Laboratory. In collaboration with the Rockport Company, he has designed shoes specifically for exercise walking. To give the walking foot extra support—it flattens more than the running foot because it is more relaxed—this shoe incorporates a more-rigid sole. The sole also rocks the foot forward, assisting its heel-to-toe roll.

Walking is not the only sport getting the techno-shoe treatment. For instance, the new Rykä Nitrogen ES 760, an aerobic dance shoe for women, features twenty-two 13-millimeter "nitrogen energy spheres" in the forefoot and heel. These devices, also known as "nitrogen microballoons," are supposed to enhance shock absorption.

At the Converse laboratory, model feet turn on lathe-like spits, fingered by metal feelers that feed dimensions into a beeping computer. For three years, Converse researchers have been going to athletic meets and making plaster casts of feet—400 of them so far. Thousands of casts from now, they may have enough data on different kinds of feet—women's versus men's, or women basketball players' versus women marathoners', and so on—to design better shoes.

Meanwhile, the evolution of running shoes has reached the point where some designers now are com-

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A perspiring volunteer ran on a treadmill while a display screen provided maps of the forces his feet generated inside his shoes. In the future, machines may use such data to custom-manufacture shoes.

pensating for overengineering. Not long ago, an Adidas employee in Germany injured himself running. He diagnosed the problem: the modern running shoe is so studded with motion-control devices that it can grip the foot like a vise. Now Adidas is marketing a line of shoes that offers foot liberation via grooves cut crosswise through the sole under the arch, separating the rearfoot from the forefoot. Other companies are trying another approach, putting together a shoe that simulates the bare foot's bounce. They call it "energy return." As of six months ago, this was the newest buzzword in the business.

You can choose from among Etonic's Dynamic Reaction Plate (a springy fiberglass wafer under the heel), Saucony's Torsion Rigidity Bar (a plastic insert in the midsole), Converse's Energy Wave (a new kind of synthetic foam material), Reebok's macaronilike tubes of Hytrel (a plastic material implanted in the midsole or heel) and Avia's Arc (an under-the-heel gizmo that looks like a centipede doing knee bends). "According to our mathematical models, Energy Wave has a 17 percent performance advantage over EVA," says Rick Bunch, manager of the Converse company's biomechanics laboratory. He adds, "For a competitive runner, that can be a lot."

Indeed it can, with Olympic records often broken by a split second. But the typical buyer of a running shoe is no Olympic athlete, or any kind of athlete, for that matter. Americans bought more than 100 million pairs of athletic shoes last year. Although they're engineered for sport, about 80 percent of those shoes are destined strictly for casual use. As a Converse executive puts it: "Performance is now *fashionable*."

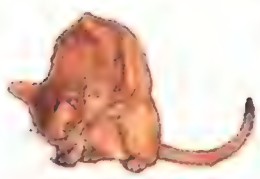
While the typical sneaker buyer doesn't get much beyond mall marching, what of us ordinary runners who do? How do the new developments affect the workaday plodders who probably will never be in the cheetah category?

"Energy return for elite athletes is very relevant; for the average runner, it's smoke and mirrors," says Peter Cavanagh, director of the Center for Locomotion Studies at Penn State University.

Cavanagh, one of the gurus of modern running-shoe design, is a lean, bearded biomechanics expert who speaks in the accent of his native British Midlands. A consultant to professional sports teams and the U.S. Olympics program, he sometimes lopes along behind other runners in races, eyeing their gait, afterward offering them tips on shoe selection. While I talked with him in his modern laboratory under a Penn State basketball court, a perspiring volunteer ran on a treadmill while a computer produced maps of the forces his feet were generating inside his shoes. Another man, trailing wires, vigorously pedaled an exercise bike. Cavanagh was showing me a high-tech running shoe he had designed for the Puma company. It was

Spend 24 hours as a cat and you'll swear off supermarket pet food forever.

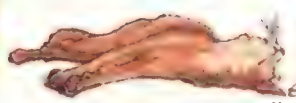
6 a.m.: Utilizing energy stored during sleep.



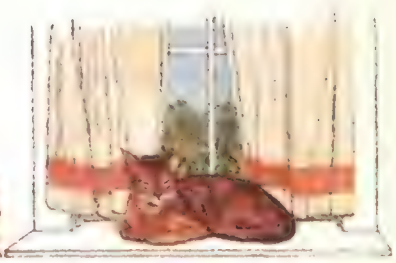
7 a.m.: Preening–along with quality fat in diet–promotes a shiny coat.

8 a.m.: Eating a concentrated, balanced mix of essential nutrients.

9 a.m.: Balanced nutrients and fatty acids keep nose and footpad leather pliable.

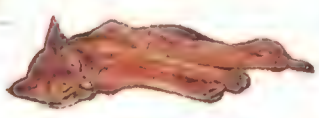


10 a.m.: Repairing cell tissues during nap.



11 a.m.: Even while sunning and dozing on a window ledge, leg muscles are being flexed.

Noon: Jumping five times one's height.



1 p.m.: Long, deep sleep rebuilds muscle.

2 p.m.: Metabolizing linoleic acid in fat helps keep skin free of flaky deposits.

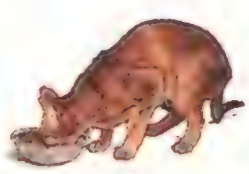
3 p.m.: A cat that feels good, looks good. And flaunts it.

4 p.m.: Nature calls. More meat protein means more food is absorbed which means less stool.

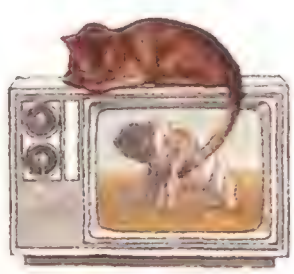
5 p.m.: Stop to play with a ball.

6 p.m.: Swatting furiously at imaginary prey.

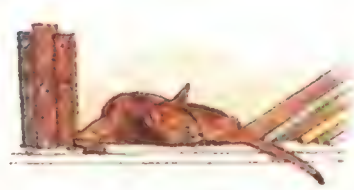
7 p.m.: Leaving scent by performing figure-eights around your feet.



8 p.m.: Eating a dry food such as Iams exercises teeth and gums while reducing tartar.



9 p.m.: Finding a warm spot to–you guessed it–nap.



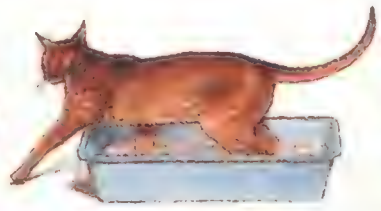
10 p.m.: Body uses taurine in food to guard against blindness and heart disease.

11 p.m.: Quality fat keeps energy at optimal level.

Midnight: Stretching and tensing aids muscle tone.

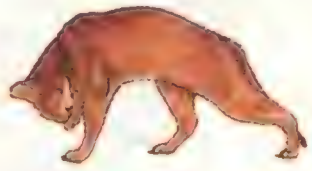
1 a.m.: Getting into mischief and the knitting.

2 a.m.: Catching another 40 winks.



3 a.m.: Low magnesium in diet helps prevent F.U.S.

4 a.m.: Vitamins in food promote clear, alert eyes that quickly adapt to night vision.



5 a.m.: Meticulous grooming improves skin and coat. But it's no substitute for eating a balanced diet.

Sleeping two-thirds of the day away may not look like hard work, but your cat still requires the maximum nutrition in Iams to look and feel her best.

Because much like the lion, who sleeps 20 hours a day, cats burn up massive amounts of energy in short bursts. Like jumping five times their height to swat at a moth.

So, to replenish that energy, your cat needs the concentrated, complete nutrition contained in Iams. She needs its real meat protein–which is easier to digest and utilize than the vegetable protein found in most supermarket cat foods and results in smaller stool. She needs its quality fat for a shiny coat. Along with an optimal balance of carbohydrates, vitamins and minerals.

For the kind of efficiency that pays off in a healthier cat, look for Iams Cat Food or Kitten Food. You won't find it in supermarkets, but you will find it in pet stores, feed stores and veterinary offices. For more information, call us toll-free at 1-800-525-4267 (IAMS).

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equipped with a computer chip in the heel. "After you run, you plug the chip into your computer at home, it unloads the data and gives you the average speed for your run, whether you've bettered any of your personal records, and discrepancies between goals you've set and your actual performance."

That particular product has been taken off the market but electronic shoes may yet become the sneakers of tomorrow. Someday shoes might record everything from your heart rate to the distance you run, your speed, your estimated calorie consumption and whether you're favoring one side or the other. Eventually, shoe-store clerks may use a machine that determines the pressures your foot exerts. Then a computer will add chemicals to a variable-density polyurethane midsole at various points, tailoring the shoe's cushioning and support specifically to your foot.

For a longtime sneaker junkie, this is a heady vision, but I want to run faster *now*. And so I recently put on a new pair of lightweight racers featuring the latest developments in energy-return systems. A friend and I headed out along a familiar road one afternoon, running easily for the first five miles as I broke in the shoes. Then we sped up for the sixth mile. When I checked my watch, I was astonished. For that final mile, we had hit a speed that, for us, was blazing: 6 minutes 26 seconds. Clearly it was a triumph of modern sneaker engineering.

But wait. My friend had run just as fast—and he was wearing battered, eight-year-old shoes that were made long before energy return became a big deal. They were so broken down, his heels canted toward the outside like listing ships. Also, his left big toe was poking out through a hole.

So there it is: one middle-aged jogger's nonscientific evaluation of the current state of hype in sneaker R&D. My findings are consistent with the heretical hypothesis that an $80 pair of advanced racing shoes performs about as well as a pair of broken-down old sneakers with holes.

But what does it all mean to the average buyer? I happened to be driving through Montpelier, Vermont, not long ago, and so I stopped at Miller Sports, downtown, and asked Mr. Miller what his customers are looking for in an athletic shoe these days. He had the answer right away. "In New England, they won't buy red," he told me. "They hate red, but they do like blue, gray and black."

It's hard to know what all the new shoe technology means to the average buyer. The owner of a shoe store in New England says his customers are interested in color, not design. Red is out; blue, gray, black are in.

Considering the astonishing amount of innovative thinking our engineers have put into the Lexus luxury sedan, before we say what the LS 400 is, first we'd like to say what it is not.

It's not a car, it's an invention.

Introducing The Lexus LS 400. The Brain Child Of 1400 Brains.

Take the remarkable engine, for example.

While the Four-Cam, 32-valve, 4.0 liter V8 is extremely muscular, it's nonetheless astoundingly efficient. In fact, as of press-time, the LS 400 is projected to be one of the only 250-horsepower luxury sedans able to avoid the U.S. gas guzzler tax.*

Of course, its design has a lot to do with this as well.

Not only is the Lexus LS 400 a beautiful and elegantly contoured luxury sedan, but with a drag coefficient of only 0.29, it's also one of America's most aerodynamic.

Slipping through the air is one thing. What about slipping on the road during normal acceleration?

The LS 400 is optionally equipped with a Traction Control System (TRAC) that can actually sense when the drive wheels are beginning to slip on slick surfaces and can then help automatically limit the slip by adjusting both the throttle and brake pressure.

And to further enhance your control of the road, the LS 400 comes equipped with our advanced Anti-lock Braking System.

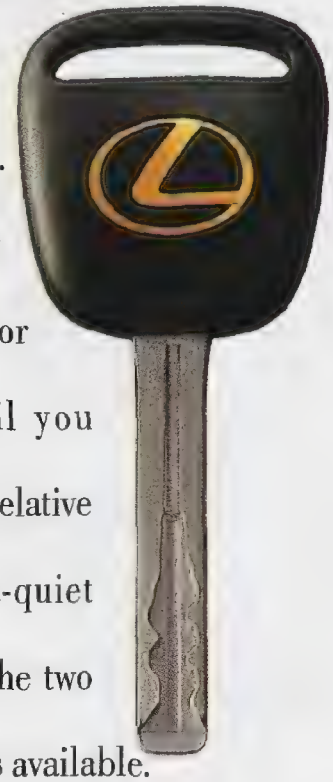
The same degree of ingenuity was reserved for the car's interior as well.

Lavished in California Walnut and optional hand-worked leather trim, the

IT'S NOT A CAR, IT'S AN INVENTION

cabin also features as standard equipment possibly the first power tilt steering wheel in America that combines the comfort of an adjustable telescopic column with the prudence of an airbag Supplemental Restraint System.

The ignition key that fits into this column is just as phenomenal. It has precision-cut inner grooves to help foil unauthorized duplication.



Now give the key a turn and listen.

You won't hear much of the engine or anything else until you decide to break the relative silence of our ultra-quiet cabin with either of the two superb audio systems available.

Of course, now that you've started the engine, the best is yet to come: your chance to test drive the LS 400.

After all, our engineers have had six years to contemplate our new Lexus luxury sedan.

Now it's your turn.

Est. 18 city/23 hwy. preliminary 1990 mileage figures determined by Lexus. See your dealer for details.

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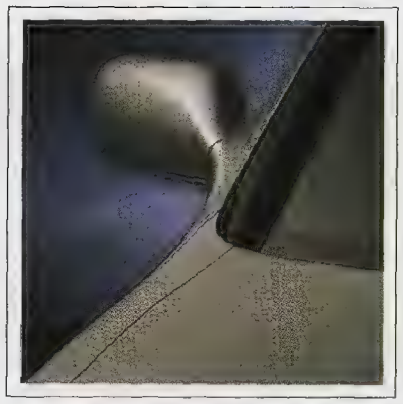

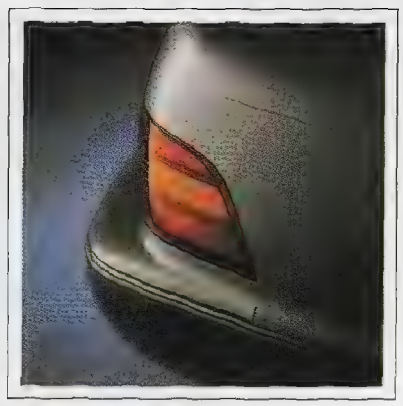

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Amazingly, They Agreed On Two.

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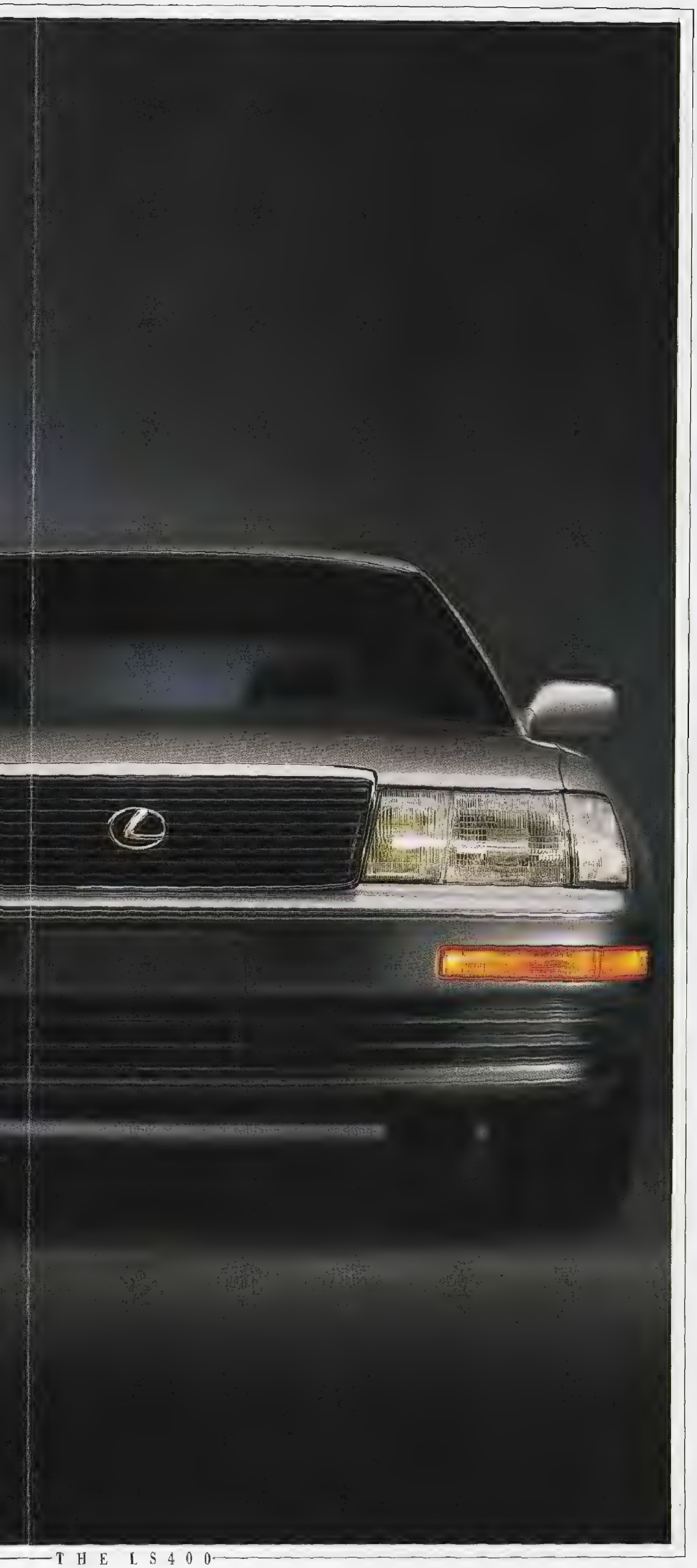

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Write to Smithsonian National Associate Program, Washington, DC 20560 or call (202) 357-4700 for tour and seminar brochures.

By James Tabor

The wild boar is a formidable foe and an admirable pest

Revered by hunters for centuries, boars have been going hog wild in this country recently—but they still have their fans

Nosy old sow accompanied by piglets investigates a disturbance in the brushy wilds of southern Texas.

The thrashing, gnashing, snorting creature to which I found myself clinging in a Texas thicket a short while ago was jet black in color, with a stiff coat, a pair of three-inch tusks and little eyes that glimmered like burning coals. Although he weighed only 100 pounds or so, he was astonishingly strong, and my companion and I had all we could do just to hold him down. It had not gone unnoticed by the two of us that those razor-sharp tusks were slashing uncomfortably close to our legs, which, for all we knew, might well be minced into bloody sausages by the time help arrived.

The object of our attention—we'll pick up on the action a little later—was not a panther. It was a hog. A wild boar, to be more exact, a member of the species *Sus scrofa*—the same Suidae family to which Porky Pig and all of his domestic brethren belong.

Though we humans often treat pigs as objects of scorn and derision, the fact is that they've been making a good living on this planet a lot longer than we have. The species evolved in India 30 million years ago and later spread throughout Europe, Central Asia and Africa. Cave paintings in southern France reveal that wild hogs provided both inspiration and nutrition for our prehistoric forebears. The ancient Greeks, who were enthusiastic hunters, considered the boar a prey of mythic stature. The historian Xenophon provided this fantastic description: "Such is his vigor that there is in him what no one would suppose; for so hot are his tusks when he is just dead, that if a person lays hairs upon them, the hairs shrivel up; and when he is alive, they are actually on fire whenever he is irritated; for otherwise he would not singe the tips of dogs' hair when he misses inflicting a wound on their bodies."

Tusks on hefty European boar, granddaddy of Suidae family, are used as weapons when fighting other males.

In medieval times, wild boars were hunted so intensively in England that they disappeared there altogether. *Sus scrofa* continued to flourish in other parts of Europe, however, and spread to the New World as well. Columbus probably introduced the first hogs in 1493 and, in 1539, when De Soto began his sweep up through Florida into the American Southlands, herds of domestic hogs accompanied him. Hundreds escaped, reverted to feral ways and established populations that survive in most parts of the country to this day. Basically there are three kinds of boars here: domestic hogs gone wild, European wild hogs and crosses of these two.

Perhaps because of their long association with it, Southerners have an especially high regard for the boar. Arkansans nicknamed their beloved state university football team the Razorbacks. Modern-day hunters in the South pay princely sums to pursue boars on private preserves. Nowhere, though, does boar love flourish more fervently than in the fabled Big Thicket of southeastern Texas, part of which is a national preserve. This 300,000-acre basin, called a "biological crossroads" by scientists, sustains an extraordinary di-

Boar at bay inflicts heavy damage on hunting dogs in engraving from 17th-century German painting. Such behavior has given hogs a reputation for ferocity, but self-defense when cornered is a natural reaction.

versity of life; 1,000 kinds of flowering plants, including 200 species of trees and shrubs, and more than 400 different kinds of reptiles, birds and mammals. Of all these species, none is more esteemed than the "piney-woods rooter," as locals fondly refer to the boar.

John Brett's livestock-auction office in Raywood, a Thicket town straddling Highway 90, about 50 miles northeast of Houston, is hung with boar heads. Dempsey Henley, a judge in nearby Liberty, the county seat, maintains his own private boar preserve. Along local thoroughfares, there is ubiquitous evidence of the animals' rooting. Up the road in Daisetta, everyone still laughs about the day in 1926 when a half-dozen or so hungry boars "charged" through the town's movie theater, clearing the house. (One old-timer says it probably didn't happen that way. More likely, several pranksters gathered up the wandering animals and shoved them into the theater as a joke.)

And then there is Bill Brett, 66, John's father and the Thicket's premier boar booster. A onetime cowboy with a leathery face and rough hands, Brett lives near the Thicket town of Hull in a pine-board ranch house bulging with boar regalia—skulls, jawbones, tusks, photographs, china figurines. His wife, Annalou, wears a necklace of boar tusks and cartridge casings. "Hell, Texas oughta have a razorback on its flag 'stead of the danged longhorn," says Brett, who now writes Western novels. "Wasn't for them hogs, this country might never of got settled. They was wild hogs all around here when folks come over from Louisiana and Tennessee in the 1820s. I was born in 1922, and we was still usin' hogs the same way. We got meat, grease, strong lye soap, sauss [headcheese], sausage and casings. Sewed shoes from the bristles. We used ever'thin' but the squeal."

There was another dividend. With all four North American species of poisonous snakes—coral, copperhead, rattler and cottonmouth—abundant in the

James Tabor has written for Time *and* Outside, *and was host of the PBS television series* The Great Outdoors. *He lives on a farm in Vermont.*

In modern version, dogs hold a "pineywoods rooter" at bay in the Big Thicket of southeastern Texas. Goal of this hunt is not to dispatch the animal but rather to capture, castrate, earmark and then release him.

Thicket, it was a nightmarish place to plow. Boars, immune to snakebite, dine gleefully on these reptiles. So where boars flourished, snakes disappeared. The rooting, wallowing animals even helped farmers clear out the Thicket's notorious underbrush, giving rise to the term "brush hog," which is more often applied today to the mowerlike machines farmers tow behind tractors to clear their fields.

Denizens of the Thicket no longer sew boar-bristle shoes, but they still love to hunt the boar. Garland Taylor and James Poitevent—good friends of Bill Brett—go hunting every chance they get, and recently they agreed to take me along, which is how I happened to end up hanging on to one of their favorite animals. You've seen Garland and James before—in Civil War photographs of Robert E. Lee's infantrymen. They have the same muscle-and-bone bodies, rawhide faces and piercing eyes. Their tough looks are deceptive, however, for personally these two lifelong cowboys are as warm as Dixie sunshine. Traditionalists to the core, they hunt the old-fashioned way—on horseback with "hog dogs," which are also referred to as "curs" but should not be confused with mongrels. These mud-brown, shorthaired, 40-pound dogs are carefully bred by their owners, and the result is a whip-lean animal that's in keeping with a Thicket adage, "Thin hound for a long race."

Actually, there are two kinds of curs. Chase dogs specialize in what their name suggests; they pursue hogs and will run all day if they have to. Catch dogs take over when the chase dogs have cornered their prey; they hold the hog at bay and won't hesitate to leap on a boar ten times their size. Because they are so good at what they do, top hog dogs will sell for up to $500 apiece. Hunters routinely take needle and thread with them into the field. In the event any of their valuable dogs are cut by boars, they usually patch them up right away.

Though they are descended mainly from feral domestic hogs, the boars hereabouts, having lived in the wild for nearly five centuries, are nothing like their barnyard relatives. As is the case with all wild boars in

Weary sportsman Garland Taylor heads home after long day spent chasing razorbacks through the Big Thicket on horseback.

Texas writer Bill Brett uses part of a skull to show how wild hog hones its tusks, by grinding on upper protrusions, or whetters.

North America, they look and act more like their Eurasian ancestors. Their coats consist of coarse black or reddish guard hairs with a softer undercoat. Their tails are straight and their snouts elongated. ("A full-blooded razorback's nose is so long he can eat corn out of a quart jar," goes an old Thicket saying.) Their big ears stand stiffly upright. Domestic pigs, by contrast, have short coats, curly tails and flopped ears. Wild boars average about 5 feet in length and stand nearly 30 inches at the shoulder. They can weigh more than 500 pounds, but older adults average 325. They are lean rather than porcine, with massive shoulders and low hindquarters. Their most conspicuous trademarks, however, are the lower canine teeth that develop, on males, into those enormous ivory tusks—"tushes," in Big Thicket vernacular.

The tusks are sometimes employed as weapons, especially in the heavy fighting that occurs between males during the mating season. Bill Brett considers a male razorback at the prime of life to be one of the most dangerous animals in the Western Hemisphere. Normally he is not aggressive except when threatened, Brett says, but he's unpredictable, strong and quick, and he knows how to use those tusks. The teeth keep on growing as long as the boar lives. They are kept sharp by constant grinding against two corresponding teeth that grow sideways (more or less) out of the upper jaw. These teeth are called whetters (above).

"When a boar fights," Brett told me, "he opens his mouth and throws his head sideways and up, and then jerks it back. Lots of times this leaves two cuts, one from the tush and one from the whetter. He's at his peak as a fighter from about 2 years old, when his tushes are an inch and a half long, to about 6 years old, when he begins to lose a little of his quickness, and his tushes start getting long enough to curl back some and not hit straight in."

Back when Brett was hunting razorbacks regularly, it was common practice in eastern Texas to give the big male breeders a wide berth because, when antagonized, they could be so hard on horses and dogs. He says he is personally aware of one man, one bear and perhaps a dozen dogs that have been killed by boars.

If the wild hog's tusks are its principal weapons, its snout is its trusty main tool for locating and digging up food. Boars are omnivorous. They will eat just about anything they can root up: grass, weeds, snakes, rodents, carrion, tasty bulbs, wildflowers, even tree bark on occasion. The animals feed primarily on "mast," or nuts—acorns, beechnuts, pecans. In the fall, an adult will eat 200 pounds of nuts per month. Mast availability, in fact, is the factor that has the greatest impact on wild-boar populations.

Boars remain active throughout the year, foraging constantly. When mild winters coincide with plentiful mast crops, sows can farrow (give birth) twice a year,

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with four to ten piglets in each litter. (The word "farrow" is derived from the Old English term "fearh," meaning "young pig.") According to wildlife biologists, that makes wild hogs potentially the most highly reproductive large animals on the continent.

Several mature sows and their offspring live together in a group called a "drift." Males are solitary; they leave the drift as yearlings and live alone. After mating, sows remain with their drift for about four months; then they retire to give birth alone. The sows often make farrowing nests of leaf-lined holes in the ground. They also farrow in caves or abandoned farm buildings. Infant mortality is high, as the piglets are preyed on by bears, foxes, bobcats, coyotes, mountain lions and other hogs. Youngsters lucky enough to survive until they become adults are likely to live for eight or ten years.

Boars rarely range more than five miles from the area of their birth unless driven to do so by depletion of food supplies. According to David Synatzske, a wildlife biologist who has studied wild hogs extensively in Texas, their preferred habitat is moist bottomland—marshes, sloughs, creeks and floodplains. That's true partly because of the abundance of mast-producing trees in such areas, and partly because boars need wallows to cool off in during hot weather.

It was through just such swampy, boggy country that I found myself riding horseback with Garland and James early on a warm November morning. Once or twice a year, my companions told me, they will kill a boar for "eatin' meat" but this time the chase was just for fun. We loped along behind the seven dogs, following the sound of their barking. When they strayed too far, James and Garland retrieved them with "callin' horns," primitive cow-horn trumpets that emit a skin-tingling wail. Finally, the dogs hit a hot trail and shot off like rockets. The race was on. For 15 minutes, we galloped through thickets and burns, leaping creeks, skidding across downed loblollies, slashing between giant oaks. Finally the boar bayed up in a tangle of seemingly impenetrable briars. James rode right through the thorny vines and I followed him in. That's when we grabbed the young male's hind legs.

He had slashed two dogs. (One of them had to be taken home and stitched up.) Four others were hanging by their teeth from his ears and shoulders. James and I managed to push him over and kneel on his neck. Garland had gotten tangled up in some vines

Group of wild hogs, called a "drift," forages through Texas woodland. The animals prefer acorns and other mast but also root up rodents and snakes. They're smart, have good ears and nose but can't see very well.

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The boar, granddaddy of all pigs

Snow clings to snout of big boar looking for food in upper Minnesota. Layer of fat insulates hogs from cold.

on the other side of the thicket and we were beginning to wonder how much longer we could hold out when he finally crashed in, panting, and evened up the odds. We kept the animal down until Garland castrated it and cut James' registered mark into its ear. Castration improves the quality of boar meat if the animal is later killed for food; earmarks identify a boar's owner, just as brands do on cattle. Then we released our captive and it charged off.

"They don't always run away like that," James said. "Sometimes you learn tree climbin' real quick." We mounted up and rode homeward, hunt-flushed, gabbling like children. Summing up the day, Garland said, "A man has to earn his living. But I tell you what—ain't nothin' I'd druther do than chase these hogs."

Elsewhere in the United States, boars are less well regarded. One night last summer, a lieutenant in the Florida Air National Guard, Sam Carter, was landing his F-16 at the Jacksonville International Airport. "Shortly after I touched down, something hit the airplane and the left landing gear collapsed," he recalls. "The aircraft veered off the runway at 100 knots. I had no steering control, so I ejected." The fighter was nearly totaled. Carter was unhurt after parachuting onto the runway. People came running up and told him he'd hit two boars. "Mine wasn't the first case of boars on the runway," Carter says. "But since then they've started a rather intensive control program at the airport."

It's no more intensive than the one being conducted at the Great Smoky Mountains National Park in North Carolina and Tennessee, where proliferating wild hogs

Piglets huddle together for warmth on a bed of wood shavings at a preserve in Minnesota. Litter sizes range from four to ten.

Boar cools off on a humid day in central Texas. Wallowing hogs frequently mess up waterholes for cattle and other livestock.

have been a big problem. Originally brought in to stock a private hunting preserve, the animals now roam the mountains by the hundreds, threatening water supplies with their wallowing, competing with other mammals for mast supplies, and destroying endangered plants and animals with their rooting. In the process of trapping hogs for relocation outside the park, rangers have experimented with a variety of scents and baits to attract them. The preferred scents: Boar Mate (a female pheromone), corn mash, creosote, fish oil and snake feces. The preferred baits have been corn mash, corn mash with spoiled milk, corn mash with strawberry flavoring (for juveniles) and corn mash with beer (for adults). In remote areas, the animals are trapped alive for removal or, in a few cases, shot by rifle teams. During the past two years, nearly 90 percent of the wild hogs in the most densely populated areas of the park have been removed.

There's also boar trouble up North in Croydon, New Hampshire, a village of 480 people, 15 miles east of the Connecticut River. Neighboring Cornish is famous as the hideout of the reclusive author J. D. Salinger, but hardly anyone realizes that sleepy Croydon is home to North America's largest population of pure-blooded European wild boars. For this dubious distinction the citizens of Croydon have Austin Corbin to thank. A native of Newport, New Hampshire, who made a fortune in real estate, railroads and banking, Corbin imported wild boars to the state in 1890.

With the kind of flamboyance that was typical of the previous century's richest men, Corbin founded Manhattan Beach and helped develop Coney Island in New York, proposed a subway system for Manhattan and built a huge mansion on his family's farm in Newport. He was a devoted conservationist, far ahead of the times in his concern for endangered species, as a 1907 history of Cornish attests: "Mr. Austin Corbin . . . had become aware that the noble buffalo of the country were fast becoming extinct, and that other animals of note were about to share the same fate, which aroused him to the sublime project of preparing an asylum wherein a few at least of these valuable animals might be preserved from the avarice, cruelty, and greed of man."

The "asylum" was a 28,000-acre tract purchased from area farmers for about $200,000. Corbin surrounded it with 11-foot-tall fences and hired a full-time staff. The park's first occupants included 30 buffalo, 140 deer, 35 moose, 135 elk and 14 wild boars.

Not all of the species thrived in the harsh mountain climate. By 1908, only 50 elk survived. Boars, though, displayed the amazing adaptability that has allowed them to prosper all over the world in habitats ranging from tropical jungles to subarctic steppes. By that same year, 1908, *their* original population of 14 had exploded to 500.

Following Corbin's death in 1896 (he was thrown from his carriage when his horses bolted), the sanctuary was acquired by a group of wealthy Bostonians and New Yorkers who turned it into a hunting preserve. That it remains to this day, owned and maintained by the Blue Mountain Forest Association, a club of 30 men who reportedly pay up to $100,000 for membership. I tried to meet the association's pure-blooded boars face-to-face but was thwarted by the group's

Workers force hog into pen for an examination in study of feral pigs on California's Santa Cruz Island.

passion for privacy. Kneiland Wheeler, a local resident who at the time I talked to him worked for the club as its superintendent, had been ordered not to speak with reporters. In a phone conversation, he would offer only sketchy details. "We have the largest population of pure-blooded boars in the U.S.—between 500 and 1,000 animals," he claimed. "Biggest ever shot here went about 480 pounds. They're harder to hunt than bear." Wheeler told me that no boars have been introduced since Corbin's original infusion. "Hell, we don't *need* new ones," he said. "They reproduce like crazy."

It's not the animals' reproduction rate that bothers people who live in Croydon. It's the fact that so many of them seem to end up on the loose. They've been escaping for years through the preserve's deterioriating fence. Homeowners Dwight and Janet Davis had their lawn Rototilled by a rooting fugitive last year. A Croydon trick-or-treater was terrified by a tusked intruder on Halloween in 1987. That same month, after a severe storm damaged fences, a group of about 30 boars got out and residents suspect that few of those fugitives were ever recaptured.

Any Blue Mountain purebloods roaming New Hampshire's woods reproduce among themselves but they also mate with domestic hogs every chance they get. When this kind of interbreeding occurs, the European boars' physical characteristics achieve almost total genetic dominance, so the hybrid offspring become just as aggressive as the wild hogs. That prospect has some locals unnerved. "There are a lot of children in the area," Allen Tice says, "and [the boars] are getting pretty bold. I don't want to wait until somebody gets hurt before we do something."

None of this should necessarily be construed to mean that all hogs are dangerous. Consider the case of a boar named Unkie. In 1982, Blue Mountain club member Donald Healey found a two-pound wild piglet abandoned in the woods. He gave it to the hunting preserve's superintendent who in turn gave it to a neighboring farm couple, who decided to raise it as a pet. State wildlife biologists warned them that it couldn't be done—sooner or later, they said, the boar would revert to its primitive ways. The man and his wife were lifelong animal lovers; they said they'd wait and see. As it turned out, the biologists were wrong. Unkie now weighs around 400 pounds but he's housebroken and leash-trained, and he continues to delight his adoptive family with his affectionate behavior. Though his owners wish to remain anonymous in order to protect Unkie from potential harm, they agreed to let me meet him recently (opposite).

I had second thoughts as soon as I saw Unkie. He was a nightmare on the hoof. Massive. Shaped like a World War II tank. A head as big as a beer keg. His grunting sounded like thunder in a bucket and his tusks looked like ivory daggers. "Don't worry, he *loves* visitors," the owners assured me.

They were right. His riding-crop tail wagged gleefully as I scratched behind his ears. His bristly head felt like a hubcap brush, but he was very careful with those rapierlike tusks. Once I got over my fear of being slashed, I stared not at Unkie's armament but at his eyes. They were the gentlest brown eyes I'd ever seen. When I stopped scratching behind his ears, the animal gazed imploringly at me, then nuzzled my thigh and gurgled like a baby when I resumed.

Given the wild boar's reputation for nastiness, this creature's placid demeanor was astonishing. I asked the owners how they accounted for it. "We just gave him lots of love," they replied, feeding their pet his favorite snack—a Twinkie. "Animals give back what they get. He's never been hit or chased, so he doesn't dislike people."

But what about all those eons of evolution that created the *wild* boar, a beast so challenging that European kings claimed him as their exclusive hunting domain. "Wouldn't know about that," the man said. "Only problem we had was when he got too big to sit on the couch. After he grew to about 200 pounds, he wouldn't fit and we had to move him to the pen. Before that, we kept him in the house, fed him milk, cereal and baby food. He liked to sit there on the couch and watch TV."

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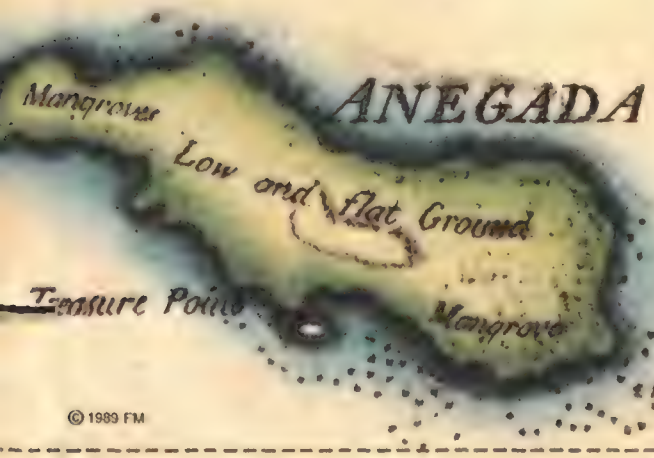

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S.M.S. KÖNIGSBERG

By Dick Houston

The Admiralty's orders were clear: 'Sink or destroy the *Königsberg*'

The crippled warship was trapped in a steamy African delta. The British Navy intended to bury her there. The Germans had other ideas

Never in his worst nightmare could Capt. Max Looff have conjured up a bleaker predicament for his mighty warship, the *Königsberg*. The sleek, 378-foot-long cruiser, with its three tall funnels, ten 4.1-inch guns and two torpedo tubes, was anchored in a mosquito-choked swamp four miles up the Rufiji River delta on the coast of German East Africa (today called Tanzania). Only hours earlier, her engines had begun to malfunction following a surprise attack on a British vessel in Zanzibar harbor. Now, just six weeks after England had declared war on Germany, here she was, hiding like a wounded tiger in a channel that twisted through a mangrove jungle filled with crocodiles.

Looff was caught in a dilemma. The nearest shipyard for engine repairs was at Dar es Salaam, 120 miles up the coast. But he dared not risk coaxing his crippled ship up there; the harbor was almost certainly being watched by the British Royal Navy. A stocky, square-jawed, methodical man, Looff paced the sweltering deck in his sweat-soaked white uniform, chain-smoking cigarettes. If he couldn't reach the shipyard by sea, might it be possible, he wondered, to get there overland instead? He stared morosely at his jungle prison. Then it came to him. The mangrove trees.

Out on the Indian Ocean, Capt. Sidney Drury-Lowe of the Royal Navy was struggling with a dilemma of his own. It was getting along toward the end of September. Ever since the war began, on August 4, 1914, one German ship, the *Königsberg*, had completely disrupted Allied shipping through the Suez Canal. It had sunk the British freighter *City of Winchester* near the Red Sea. It sank the cruiser *Pegasus* at Zanzibar. Its whereabouts, however, remained unknown, thanks to its 24-knot speed and audacious hit-and-run tactics—actions made possible by refuelings at sea from the *Königsberg*'s collier-tender ship, the *Somali*.

Britain's First Lord of the Admiralty, Winston Churchill, was outraged. "No convoys of transports are to go across the Indian Ocean or Red Sea," he insisted, "unless escorted by at least two war vessels, one of which must be stronger than the *Königsberg*." The search for the German phantom became top priority. Three of the Admiralty's newest cruisers were ordered to steam directly to Zanzibar. But when the *Chatham*, the *Weymouth* and the *Dartmouth* reached East African waters, the *Königsberg* had disappeared again.

Drury-Lowe, the *Chatham*'s commander, had a hunch Looff was skulking about in one of the many river inlets found along the snaggled coast. Then, in mid-October he captured a German liner, disguised as a hospital ship, that had been supplying the *Königsberg* and the *Somali* with coal. Among the documents found aboard the enemy vessel was a detailed map of the Rufiji delta. Drury-Lowe's suspicions were confirmed. He made plans to head for the delta.

The Royal Navy had a special reason to make the Indian Ocean safe for shipping: 8,000 soldiers of the Indian Expeditionary Force were being convoyed across it to launch a major invasion of German East Africa at Tanga. That vital harbor led directly, via the Northern Railway, to Britain's primary target, the German Army base at Mount Kilimanjaro. It was from Kilimanjaro that the colony's legendary *Schutztruppe* (defense force) had launched a series of attacks on the lifeline of British East Africa, the Uganda Railway.

Naval history's longest standoff began 75 years ago when the *Königsberg* was found hiding out in German East Africa's Rufiji River. British cruisers blocked channel until monitors slipped past Delta Detachment guns to engage enemy 14 miles upriver (red blast).

Illustrations by Arthur Shilstone

The sleek, 378-foot-long *Königsberg*, with its tall funnels, ten 4.1-inch guns and two torpedo tubes, had completely disrupted Allied shipping. But now she was cornered in a mangrove swamp like a wounded tiger.

Initially made up of only 200 Germans and 2,500 crack African troops, the *Schutztruppe* was under the intrepid command of Lt. Col. Paul von Lettow-Vorbeck. The British wanted to crush von Lettow quickly. For his part, the shrewd German intended to engage the invaders in a prolonged campaign that would force the British to divert large numbers of troops from the European theater. The son of a Prussian general and himself a battle-scarred veteran of 25 years in the German Army—14 of them spent in the colonial forces—von Lettow was convinced that his fiercely loyal Africans, though outmanned, were tough enough to bog down the British indefinitely. They were masters of bush survival. After one railway raid, a *Schutztruppe* band escaped into a parched wasteland where they survived by drinking birds' blood.

A few hundred miles to the south of von Lettow's base, Looff now demonstrated his own resourcefulness by felling dozens of mangrove trees and hammering the poles into two giant sleds upon which tons of boiler plates and other engine parts were loaded. Incredible though it seemed, he actually planned to cut a road through the brush and *drag* the *Königsberg*'s engines 140 miles to the Dar es Salaam shipyards. The brutally hard work would be done not by the Germans but by Africans who, in colonial times, were customarily forced to labor under conditions not much different from slavery. More than a thousand of those unfortunates were transferred from German farms inland to the jungle. There, as the *Königsberg*'s disbelieving crew looked on, the chanting Africans strained against the dead weight of the sleds and began moving them, inch by inch, through the swamp.

Once that grueling enterprise got under way, Looff wasted no time fortifying the delta's main channel, the Suninga, where the ship lay at anchor. He transformed its entrance into a fortress defended by cannon and machine guns. Nearly 150 men, sent from von Lettow's network of coast watchers to help man these batteries, came to be known as the Delta Detachment. Telephone lines were strung up through miles of forest to connect the *Königsberg*'s gun turrets to spotters stationed on platforms near the shore. Meanwhile, crewmen in small boats took depth soundings and discovered it was possible, during high tides, to maneuver the cruiser farther upstream through connecting waterways to the

Dick Houston is at work on a screenplay about the Königsberg. *His book* Bush Safari *will be published by E.P. Dutton next year. He lives in Lusaka, Zambia.*

northernmost channel, called the Kikunja. Thus Looff had all his bases covered in the event he was found by British warships.

One month after their departure, the exhausted Africans returned, slowly dragging the sleds alongside the cruiser while the grateful crewmen cheered. On the morning of October 30, Captain Looff stepped up to the bridge to try starting the reassembled engines, and instantly they roared to life. Looff gave thanks for his good luck. By late afternoon, he figured, the *Königsberg* could be back at sea.

Just a few hours later, however, Looff's coast watchers stared with mounting alarm as smoke from a British warship appeared on the horizon. Captain Drury-Lowe had arrived at the Rufiji. Looff got the bad news by phone and advised his crestfallen crew, "We have been discovered. Our fate is sealed."

Out on the turquoise waters, Drury-Lowe was cursing his own bad luck. The huge *Chatham* had an 18-foot draft (two feet deeper than the *Königsberg*'s), which prevented it from maneuvering over the shoals at the river's entrance. Drury-Lowe was forced to drop anchor five miles from the wall of mangrove trees that lined the Rufiji shore. But from his perch up in the crow's nest, a British sailor focused his telescope on the masts of a ship towering above the mangroves. Drury-Lowe knew it must be the *Königsberg*.

That afternoon, Looff's shore detachment watched silently as a steam launch chugged by, making depth soundings of the shoals. What the observers could not know was that the *Chatham*'s sailors were also gauging the distance from their ship's 6-inch guns to the *Königsberg*'s masts.

Soon the *Dartmouth* and the *Weymouth* joined the *Chatham*, while smaller patrol boats began steaming down from Mombasa in British East Africa. After the

Incredible though it seemed, Looff actually planned to cut a swath through the brush and *drag* the ship's engines 140 miles across trackless country to be repaired at the Dar es Salaam shipyards. As the *Königsberg*'s disbelieving crew looked on, the chanting Africans strained against the dead weight of the sleds and began to move them, inch by inch, through the swamp.

After weeks of gunnery practice, British monitors churned through murky waters toward the Kikunja.

Admiralty radioed Drury-Lowe and gave him full command of the growing fleet, he quickly deployed the three ships. The *Dartmouth*, which had a shallower draft than the other two cruisers, was maneuvered to within only two miles of the channel mouth. The *Chatham*'s ballast was shifted to give her a 5-degree list, which increased her gun range. Then Drury-Lowe gave the signal for a joint bombardment to begin.

Seconds later, a shower of 6-inch shells pummeled the channel shore, obliterating stands of mangroves, and leaving deep craters and curtains of yellow smoke. The barrage straddled the *Königsberg*, stirring up huge geysers of mud and water as debris from pulverized trees rained down on the decks. Looff ordered his panicky crew to get the cruiser under way, but she could move at only a snail's pace with her keel continually scraping the bottom. Suddenly a terrific concussion shook the delta as the *Somali*, hit dead on, was instantly transformed into a blazing furnace. As the *Königsberg*'s crew watched, a black column billowed hundreds of feet above the jungle. The men knew they were seeing their best chance of escape go up in smoke. The *Somali* had been carrying 800 tons of coal; the *Königsberg* kept only 200 tons in order to remain light enough to maneuver in the shallows.

London desperately wanted a Rufiji victory

Eventually Looff managed to get far enough upstream to elude the British guns. When Drury-Lowe tried to send a makeshift torpedo boat after him, it was repulsed at the mouth of the channel by ferocious fire from the shore batteries. Drury-Lowe then radioed the British military to inquire about reinforcements that could smash the German defenders, only to learn some shocking news. In just two days of fierce fighting, von Lettow's *Schutztruppe* had whipped the Indian Expeditionary Force at Tanga and sent them packing back to Mombasa. No troops could be risked now for the Rufiji. Even so, humiliated by defeat at Tanga, London desperately wanted to have a victory at the Rufiji, troops or no troops. "Sink or destroy the *Königsberg* at any cost," the Admiralty commanded.

Drury-Lowe was determined to bring Looff to his knees. The question was, How? He decided, since he couldn't pursue the Germans up the creek, to make sure they couldn't get out. He brought in a huge old coal ship from Zanzibar and scuttled it in the deepest part of the lower Suninga. Then he advised the Admiralty that the *Königsberg* was bottled up for good.

Or was it? The British commander began to have second thoughts. Maybe there was another way out of the delta. Perhaps, at high tide and after dark, his nemesis might yet be able to slip away. And there was another problem. The mud near the mouth of the

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The Delta Detachment turned main channel entrance into a fortress bristling with cannon, machine guns.

channel was clogging the ships' engines, forcing the vessels to return at intervals to Mombasa for cleaning. Even when Looff was trapped, he continued to frustrate the mightiest navy in the world.

Drury-Lowe decided he simply had to have a way to keep an eye on the Germans. He radioed South Africa for immediate assistance, and on November 15 the British liner *Kinfauns Castle* arrived off the Rufiji from Durban, bearing a rickety Curtiss flying boat accompanied by a daredevil pilot named Dennis Cutler. On his first flight over the delta, Cutler got lost. On his second attempt, he didn't even get off the water before the radiator exploded. On his third try, Cutler finally spotted the *Königsberg*, but shortly thereafter was forced to make a rough landing at sea that damaged his plane beyond repair.

Drury-Lowe ordered up a second plane, and early in December, Cutler again took to the skies. This time he discovered that the *Königsberg* had moved eight miles farther upstream, to a point where the Suninga hooked up with the Kikunja channel. Once again Drury-Lowe's suspicions were confirmed. The *Königsberg* appeared to have complete freedom of movement after all—and options for escape, as well.

In fact, the *Königsberg* was not going anywhere. Its only hope was that a relief ship with coal might somehow come from home. The worst part was not the waiting, or even the uncertainty, but the blasting equatorial heat. Each day the sun scorched the steel hull into an oven. The paint in the cabins melted and ran down the walls. Evenings brought yet another dimension to the crew's suffering: mosquitoes that swarmed over the decks in black clouds. More and more of the men came down with malaria.

"If you want to see me, I am always at home"

On Christmas Day, Looff tried to prop up morale with special allotments of tinned food and schnapps. A radio message from the British crewmen expressed grudging admiration for the Germans. "Kony, we wish you the best of good cheer," it said, "but blame you for stopping our Xmas beer." Looff radioed back: "Thank you. The same to you. If you want to see me, I am always at home."

But as the weeks dragged on into the New Year, London was finding no humor in the exasperating stalemate. For two months the defiant Looff had diverted nearly a dozen ships from other theaters of war as effectively as if he had sunk them. The Admiralty decided to appoint Adm. Herbert King-Hall, commander of the Royal Navy's Cape Squadron, to take over. By the time he arrived at the Rufiji in early March, the fleet there had grown to 18 large and small ships. King-Hall requested a couple of shallow-draft warships that could make it up the river, and several planes suitable for further reconnaissance. The Admiralty agreed to ship out some new planes and two monitors, the *Severn* and the *Mersey*.

The *Königsberg* had last been sighted three months earlier. King-Hall needed to know what Looff was up to and he had brought with him a colorful character who could find out. Pieter (Jungle Man) Pretorius was a leathery elephant hunter from South Africa who knew the Rufiji delta better than any other white man in Africa. His assignment was to slip past Looff's coastal sentries, find the *Königsberg*, ascertain its fighting state and then make tide tables of the channel in its vicinity.

By the time Pretorius entered the picture in early March, the *Königsberg* had been transformed into a plague ship. More than three-fourths of her crew had been stricken with malaria or dysentery. Sanitation was terrible. Several men had died from blackwater fever and malaria, and another had succumbed after losing a leg to a crocodile. Food was running out; the main fare was fish and hippo meat.

Just when it seemed things could not possibly get much worse, the *Königsberg* received over the radio a message from Berlin that cheered the crew and cap-

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One day, daring Pieter (Jungle Man) Pretorius dressed as an Arab trader and went right up to the cruiser.

tain alike. A relief ship was on the way, bringing 1,600 tons of coal, and a shipment of rifles, munitions and other supplies for von Lettow. From an inland messenger, Looff had learned earlier that von Lettow's situation was becoming precarious; even as he stepped up his attacks on the Uganda Railway, the *Schutztruppe* was rapidly running out of ammunition. Looff quickly devised a plan. The relief ship would off-load von Lettow's munitions at Tanga first; then the *Königsberg* would try to break out of the delta at night and rendezvous with the other vessel off the coast of Portuguese East Africa.

While the *Königsberg*'s crewmen prepared for escape, cleaning the engines and gun turrets and slapping on a new coat of paint, they were being stalked by the wily Pretorius. His boldness knew no bounds. One day he dressed as an Arab trader, went right up to the cruiser and interviewed an African laborer who worked on board. Another time he disguised himself as a fisherman and paddled his dugout right under the *Königsberg*'s nose, taking depth soundings with a long pole. Through him, King-Hall pinpointed the *Königsberg*'s location and learned that her big guns were operable, and that her crew was tending to business.

An outrageous ruse—but it worked

The German relief ship was actually a captured British freighter disguised as the Danish vessel *Kronborg*. She had left Germany in mid-February and had slipped through Britain's North Sea blockade in a storm, but in early April her luck ran out. When her captain, Lt. Carl Christiansen, broke radio silence to contact the *Königsberg*, the French at Madagascar were listening in. They heard Looff tell Christiansen to off-load von Lettow's munitions and then plan for their linkup at sea. When King-Hall got that bit of news, he jubilantly raised anchor, and his flagship, the cruiser *Hyacinth*, was off, full steam ahead, for Tanga.

When the *Kronborg* sailed within sight of Tanga at dawn on April 14, King-Hall was lying in wait. After traveling fully 10,000 miles and all but reaching his destination, Christiansen must have been appalled to see the faster ship bearing down on him, but there was no time for handwringing. He maneuvered the *Kronborg* into shallow water behind a tree-lined peninsula. Unable to move beyond the reefs, King-Hall opened fire, knocking out the German ship's funnel as other shells ripped through her hull. Defenseless, trapped, almost certainly doomed, Christiansen ordered the sea cocks opened, had oil and wood set afire on the decks, and then gave the cry to abandon ship. It was an outrageous ruse, a trick born of desperation—and it worked. Believing his guns had mortally wounded the *Kronborg*, which partially sank, King-Hall ordered the *Hyacinth* back to the Rufiji.

The next day, when the smoke had cleared from the wreck, Christiansen's men discovered that most of the munitions, sealed in watertight containers, were intact. Divers recovered 2,000 rifles, five million cartridges and tons of other supplies, which were then transported by natives to von Lettow at Kilimanjaro. After the salvage operation was completed, Christiansen journeyed overland to the Rufiji, bearing bad tidings for Looff. The fatherland, he reported, could no longer assist the *Königsberg*. Von Lettow had top priority now, and Looff was ordered to release 100 of his 313 men to reinforce the *Schutztruppe*.

The captain's reaction was predictable. If the *Königsberg* could not escape, he resolved, neither

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Miraculously, the *Königsberg* was able to knock out the British spotter plane, but by then it was too late.

would she cower. She was going to stand and fight. Quoting Goethe, Looff exhorted his men, "Rather an end in terror, than terror without end." The dreadful wait for the final confrontation began.

The *Severn* and the *Mersey* were towed into the waters off the Rufiji delta in early June. The squat, flat-bottomed monitors were identical in appearance. Each displaced 1,280 tons, was 268 feet long, had a 6-inch gun mounted fore and aft, and showed barely five feet of hull above the waterline. To act as gun-spotters for them, four land-based planes were taken to Mafia Island, 15 miles off the coast, where an airstrip had been built. The elements of the final assault on the *Königsberg* were falling into place.

At long last, the waiting was over

The success of the operation hinged on getting the monitors past Looff's formidable shore batteries. To that end, King-Hall planned to unleash a combined cruiser bombardment that would distract the enemy while the *Severn* and *Mersey* slipped by. The monitors would proceed upriver and anchor behind a large island in the Kikunja channel almost seven miles from the *Königsberg*—within range of the warship's guns, but sheltered and out of sight. Firing from that concealed position, the British ships would take their cues from spotter planes hovering above the action.

Shortly before dawn on July 6, after weeks of gunnery practice, the monitors churned through the inky waters toward the mouth of the Kikunja. Just as a faint yellow light appeared on the horizon, three booms from the German shore batteries warned Captain Looff of the impending attack. Seconds later, the Rufiji delta quaked as the British warships opened up.

Looff ordered his men to their battle stations. After being trapped in that jungle hellhole for nearly nine months, all hands felt a sense of relief verging on exhilaration. The waiting game was over. At long last, they would meet the enemy head on.

Looff's spotters stationed along the river alerted him by phone that the monitors had successfully run the shore gauntlet and were heading his way. Minutes later a plane buzzed overhead. Then the monitors appeared and began trying to maneuver behind the island as planned. Looff commenced firing all five guns on his starboard side and the battle was on.

Capt. Eric Fullerton of the *Severn* was astonished by the accuracy of the *Königsberg*'s guns. Shells were bursting in the water only a few feet away, stirring up massive numbers of stunned and dying fish. At 7:43, the German ship registered its first hit, knocking out the *Mersey*'s forward gun turret and killing four crewmen. It was beginning to look as though Looff might actually be able to turn the tide. Moments later, how-

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those hollow, aching
spasms of doubt
which often accompany
major changes
and make
lifelong dreams
seem like
a huge mistake.
Those pangs, however,
were melted
by a heartfelt gift
from her friends,
which carried with it
their love,
encouragement,
and the promise
of always staying
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The worst part was the blasting equatorial heat; each day the sun scorched the steel hull into an oven.

ever, a spotter plane radioed Fullerton the *Königsberg*'s range, and he sent five shells smashing through the German ship's galley and bridge; another blast destroyed one of its guns.

Then the monitors and the planes lost radio communications, and the ships' accuracy immediately fell off. Not long after that, a crewman on the *Severn* spotted a German gun-range platform on the island, and the monitor blasted it out of existence. Now both sides were lost without their principal range finders.

The three ships continued firing aimlessly into the swamps until late afternoon, when the tide began to recede and the monitors headed back downstream. During the nine-hour engagement, the *Severn* and the *Mersey* had fired more than 600 shells; only 6 had hit the mark. The *Königsberg* was still full of fight. King-Hall was at his wit's end. Would the *Königsberg* ever be put out of action? He set July 11 for the next assault. This time, he vowed, the job *had* to be done.

That morning the monitors again made it past the shore batteries, approaching the island just before noon. Looff opened fire as soon as they came within range. The Germans had not lost their touch. The *Königsberg*'s shells smashed into the water within spitting distance of the British ships. The *Mersey*, anchored in plain sight, hoped to draw the cruiser's fire while the *Severn* worked its way upstream. King-Hall had urged Fullerton to get as close as possible and, as it turned out, he was able to pull within a mile of the cruiser, virtually point-blank range.

The *Severn* opened up, and its big guns were dead on target, raining shell after shell on the *Königsberg*, disabling all its guns but one. Miraculously, that last gun was able to knock out the British spotter plane, but by then both monitors had the *Königsberg*'s exact range, and for the next hour and a half their firing never ceased.

The warship had become a slaughterhouse

The *Königsberg* was disintegrating under the bombardment. One shell demolished its center funnel, which crashed onto the deck. Huge holes erupted, one after another, all along its hull. The screams of the wounded could scarcely be heard above the continuous explosions. The warship had become a slaughterhouse. Mutilated bodies and severed limbs lay everywhere. The decks were awash in blood, and sand had to be shoveled onto the slippery walkways. Looff, who refused to leave the bridge, was hit by shrapnel; only his cigarette case prevented the fragment from tearing open his stomach. Finally, his uniform soaked with blood, the indomitable captain reluctantly gave orders to abandon ship.

Before he was carried off, however, Looff made a decision that would have a significant effect on the entire East African campaign: he ordered the breechblocks of the *Königsberg*'s big guns dismantled and tossed overboard. Then he told the first officer to destroy the burning ship by detonating one of its own torpedoes. He was watching from the riverbank when the torpedo exploded. "A dull noise from the ship, weaker than we expected, hardly noticeable among the enemy's shells blasting like thunder, the explosion is a success," he later recalled in his book about the African campaign. "With a little jerk, the ship goes on its side, and sinks slowly to the upper deck, and the river extinguishes the fire." Twenty minutes later a spotter plane swooped over the wreck and advised the monitors, "Target destroyed."

The monitors made their way back downstream. When they reached the fleet, sailors lining the rails of the other ships cheered and signal flags proclaimed the victory. The longest stalemate in the history of naval warfare was over.

Back up in the Kikunja, the gruesome business of burying the dead got under way. Out of the 213 men remaining on board the *Königsberg*, 32 had been killed and more than 125 wounded. Still, though her

crew had suffered grievously and the ship had been destroyed, the *Königsberg*, as Looff would declare in his diary a few days later, was "not conquered." Her ten guns, and breechblocks that the captain had the foresight to deep-six, were later salvaged by Looff's men and hauled to the naval repair yard in Dar es Salaam. There they were converted into the mightiest field artillery in East Africa. With them, von Lettow at last had the big guns he needed to defend himself.

When a major British offensive was finally launched in 1916 by Lt. Gen. Jan Smuts and 30,000 soldiers, von Lettow was ready. Smuts occupied German East Africa the following year but he failed to defeat the ever-elusive *Schutztruppe*, which escaped south and then attacked Portuguese East Africa. Only the declaration of the armistice in 1918 forced von Lettow to lay down his arms. By then he had succeeded for four years in preoccupying nearly 250,000 troops that could have been used to bolster the Allied armies in Europe. His friend writer Isak Dinesen later said of the German commander that even the English "came to feel a sort of fondness for him . . . the same kind of fondness the hunter feels for an especially fine quarry."

The same might well have been said of Capt. Max Looff and the *Königsberg*. After the war Looff wrote: "What did we do as a cruiser? . . . We could fulfill only one assignment . . . and that was tying up numerous resources, ships, and manpower of the opponent. We accomplished that as no other single cruiser in the war." The fatherland, which had consigned the *Königsberg* to her fiery fate in the African jungle, later bestowed the Iron Cross on Looff and many of his surviving officers and men. In the end, in a way, they had won after all.

The *Königsberg* was disintegrating; one shell hit its center funnel, which then collapsed onto the deck. Terrible screams of the wounded could scarcely be heard above the constant explosions. The end was near.

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The Pleasure Ships.

By David Roberts

Tantalizing to scholars and tourists, Carnac's megaliths remain an enigma

Intense speculation, some silly, some sage, has yet to explain the riddle of Brittany's massive alignments, menhirs, passage graves

As I walked down the country lane toward the old chateau, cuckoos cried from the pine trees overhead. On either side thickets of gorse blazed yellow in their April bloom. I came to an unmanned guardhouse: inside, a hand-lettered sign asked me to drop three francs in the box and take key and flashlight. From the guardhouse I followed a path across a carpet of pine needles, coming to a clearing. No one else was around.

Before me loomed a grassy mound, in the side of which I found a portal framed by granite blocks, sealed with a makeshift wooden door. I turned the key in the lock, swung the door open and, stooping slightly, left the sunny warmth behind and moved into a dank tunnel. After I could see by the wan beam of the flashlight, I edged my way along a 20-foot corridor of granite. Great slabs planted upright formed the walls, the gaps chinked with stones, while even-greater slabs laid flat overhead composed the ceiling. At the end of the tunnel, I entered a square chamber in which I could stand upright. My light played on a dim design engraved on one of the walls—a face, perhaps, or a figurine, or a shield?

It was a strange place, at once gloomy and serene. I felt the exultation of a pilgrim, for I was standing inside the passage grave of Kercado, near the town of Carnac on the southwest coast of Brittany. (Those curious structures, long corridors leading to burial chambers and then mounded over, were forgotten for thousands of years.) My mind danced with a startling thought: *This is a structure that was almost 5,000 years old when Christ was born.*

The next day, a few miles to the east, I sat on a patch of heath and pondered the gigantic object in front of me. Shattered into four clean blocks by some enormous force, the wreckage of a giant pillar that once measured 67 feet and weighed close to 340 tons lay shrouded in the enigma of its collapse. The top three pieces rested neatly end-to-end, but the mammoth base had flipped and twisted so that it pointed at an angle. Had lightning struck this great monument, or an earthquake toppled it? Or did it fall and break as its builders struggled to lift it upright?

Whatever the case, the Grand Menhir Brisé—sometimes called the "Fairy Stone"—is by a considerable margin the largest stone ever quarried and moved in ancient Europe.

When one speaks of megaliths—"great stones," from the Greek—most people think first and foremost of Stonehenge. Yet in that stunning edifice on the Salisbury Plain, the loftiest pillar is only 29 feet in

Entrance to a passage grave at Kercado evokes images of its Neolithic peoples of the fifth millennium B.C.

Photographs by Corson Hirschfeld

Colossal fragments of Grand Menhir Brisé lie scattered in front of excavations of the Neolithic mound of Er-Grah (far left) and of Table des Marchands (at right). Some archaeologists question whether the great 340-ton, 67-foot stone ever stood.

height, the heaviest some 50 tons. The first scratchings at Stonehenge are younger than Kercado by more than 2,000 years. Some 80 stones make up that most famous megalithic monument in the world; in the vicinity of Carnac, there are more than 4,000.

To put it simply, Carnac's megaliths are the most impressive in the Western world. Two centuries of poking among the Breton fields and forests have unearthed a rich collection of facts and artifacts, but the conundrum of their meaning persists. In the words of Evan Hadingham, a British writer and archaeologist who has done research at Carnac, "It's one of archaeology's most enduring mysteries. I think it poses as many tantalizing unanswered questions as the pyramids."

Around Carnac lie scores of ancient tombs—some, such as Kercado, still buried in the mounds of earth and stone that were heaped up to enclose them, others denuded of cover so that their massive walls and capstones look like the playhouses of giant children whose building blocks were granite. Seemingly at random, the moors and woods are scattered with hundreds of isolated menhirs—in Breton, "long stones"—up to 31 feet in height, some shaped and smoothed by prehistoric stone tools. But the most arresting sights in Carnac are the alignments.

If you take a small road north from the center of town, in half a mile you come to the tiny hamlet of Le Ménec. Suddenly an extraordinary sight opens before your eyes. From the edge of a few old farmhouses, a forest of menhirs stretches east across the undulating ground, almost as far as you can see. A glance reveals that the stones have been erected in rows—12 of them.

On my first full day in Carnac, I took a magical three-mile walk among the alignments, starting at Le Ménec. The spacing between the stones is irregular, and the lines themselves curve slightly. The tallest stones (up to 13 feet in height) stand at the west end, near the farmhouses, and they dwindle steadily in size as you move east. After two-thirds of a mile, the stones end in pine woods. Hiking farther eastward, I crested a small rise and found myself at the edge of Kermario, the second set of alignments.

These stretch even farther than Le Ménec's, though in 7 rows instead of 12. I stopped for a picnic of bread, cheese, sausage and beer at a ruined windmill in the middle of the array. From atop the windmill I gazed at the rows of stones marching away on either side.

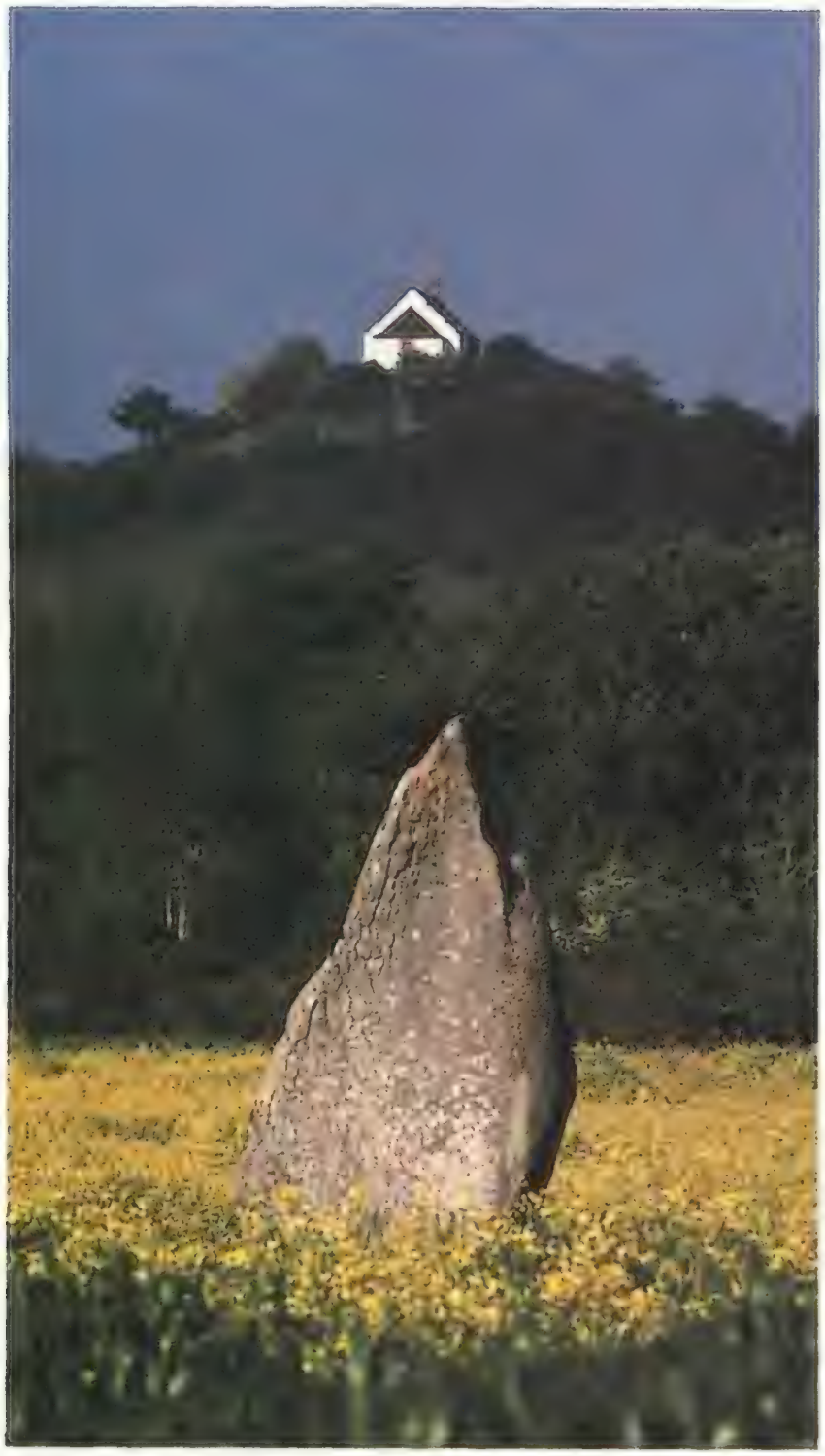
Another thin forest intervenes before the onset of the Kerlescan array. Here 13 rows extend for a mere 400 yards, but it seems likely that there were once many more stones, for the alignments run smack into the old village of Kerlescan, whose very houses may have fragments of menhir all through their stonework. By the end of my walk, having strolled past 2,471 standing stones, I was in a happy trance. Never before had I seen anything like these rows of granite pillars.

It is hard to imagine that the alignments could ever have been taken for granted—yet, astoundingly, there is no written mention of them before the 18th century. Once travelers and antiquarians began, in the 1720s, to pay attention to those anomalous ranks of upright stones, a relentless parade of theories to explain them was launched.

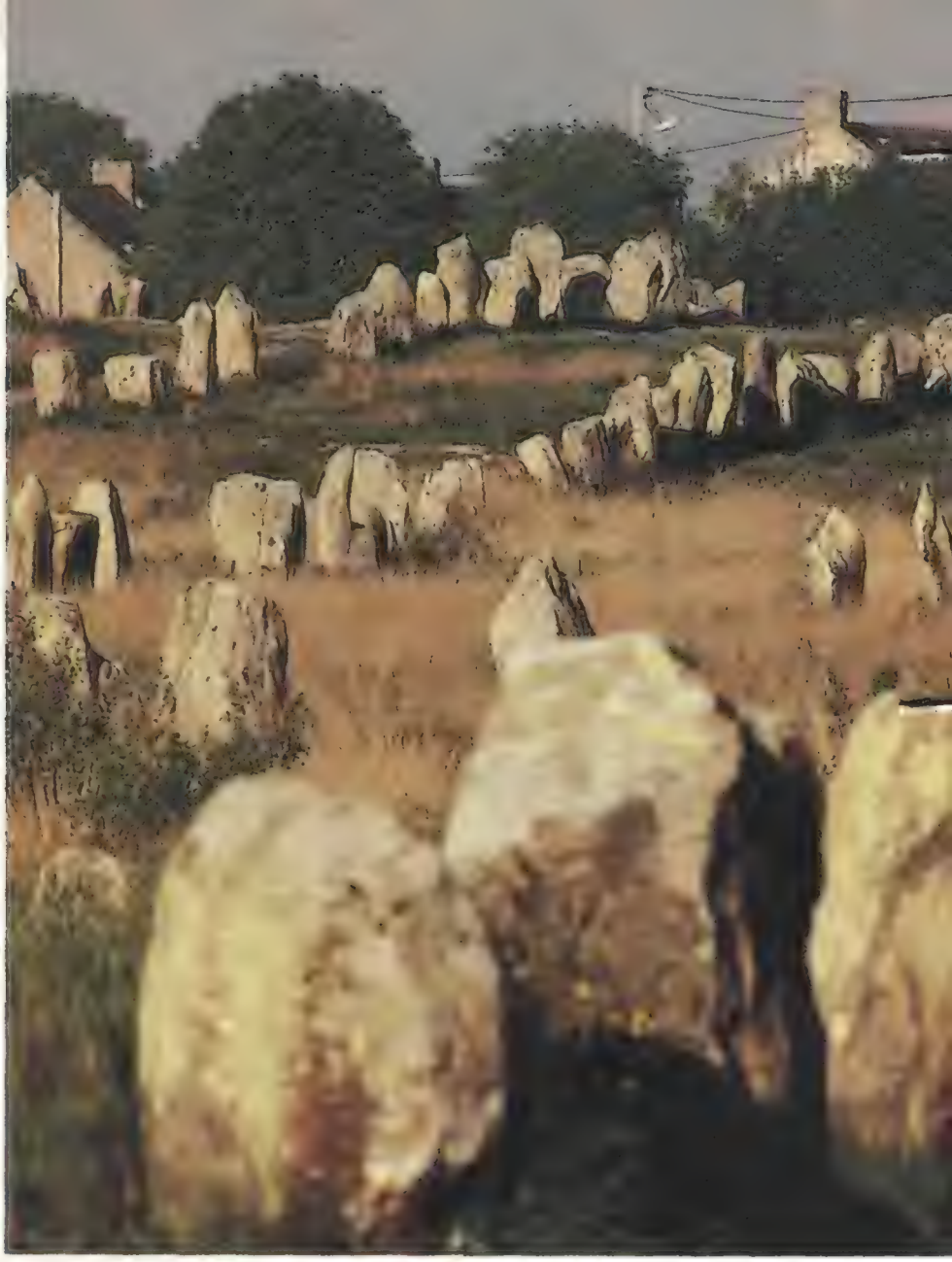
The patron saint of Carnac—a very local one, unrecognized by the Vatican—is Cornély, to whom the village church is dedicated. Cornély's chief function is to

The author recently used his mountain climbing skills to help archaeologists studying ancient, abandoned cliff dwellings—80 feet up a sheer cliff in Central Africa.

Carnac alignments stand in series of 7 to 13 rows, are interrupted here and there by roads and structures. These, at Le Ménec, meander toward farms sprinkled throughout pine forest (at top of the photograph).



Surrounded by wildflowers, menhir of Kerluir points toward a Christian chapel atop Tumulus St.-Michel.



Today, men and menhirs coexist at Le Ménec, where farmers' tidy cottages contrast with the rough stones.

protect cattle. We know that in 56 B.C., during his subjugation of Gaul, Julius Caesar won a great battle against the Veneti somewhere in the neighborhood of Carnac. When Parisian intellectuals began to descend on the region in the 18th century, locals offered their explanation of the alignments. Fleeing from a troop of Roman soldiers, they said, with only a pair of oxen to carry his gear, Cornély had climbed a hill just north of today's village. In a miracle, he turned the pursuing Romans to stone. They stand there today, no two alike, frozen in their steps, transformed into abstract granite.

While discounting the legend of Cornély, the Parisians made the natural assumption that the menhirs were contemporary with Caesar, who remains the chief classical source for our knowledge of the Gauls (Celts living in what is now France) and of their elite, the Druids. The alignments, then, thought the early investigators, must be Druid temples. Caesar had described gruesome human sacrifices carried out by the Druids. The intellectuals had no trouble finding recumbent stones, which they called *tables de sacrifices*, whose naturally eroded contours they mistook for sculpted hollows that perfectly fit the human body.

Though quarries were nearby, moving thousands of gigantic granite stones, without wheels, was herculean.

The Croix-Hahon may be a Christianized menhir—or a Christian symbol inspired by the menhir tradition.

This was far from the wackiest theory propounded by earnest students of the alignments during the next two centuries. In the early 19th century, a new generation of savants saw serpent-worship everywhere: the alignments themselves, with their curving "sinuosities," imitated the very shape of snakes.

Other learned explanations over the years interpreted the alignments as fish-drying platforms, markets, hotels, routes to the stalls of prostitutes, and fields for ancient analogues of cricket or bowling or golf. One thinker deduced that the Romans had actually erected the stones as windbreaks for their tents. In the 20th century, it has been suggested—though certainly not by a scientist—that the alignments are the remains of ramps and landing pads used by extraterrestrials to visit Earth.

Although one shrewd investigator had suggested as early as 1764 that the megaliths might be pre-Celtic, it was only after the first responsible excavations, more than a century later, that this view prevailed. By the 1950s, archaeologists had studied thoroughly the artifacts of the megalith builders and had reached a conclusion about their age based on comparisons with the great literate civilizations of the Near East. They concluded that the megaliths spanned the years 2000-1400 B.C. The general outlines of the spread of cultural influence were clear to them also. From a Neolithic cradle in the eastern Mediterranean, ideas traveled north and west, by land and sea, over the centuries. Stonehenge bore the imprint of a Mycenaean prince; the art of Carnac was abstracted from goddesses of Crete and Egypt.

The experts were in for a great shock. The new technique of radiocarbon dating began to furnish a chronological precision that had eluded traditional archaeology. In 1959, the first tomb in Brittany to be carbon-dated seemed to give the impossibly early date of around 4300 B.C. It was no mistake. Site after site revealed origins in the fourth and fifth millennia before Christ. The oldest date yet established is Kercado's, with a carbon reading of 4650 B.C.—making the somber passage grave in the pines some 3,000 years older than experts had sworn it was.

All the early theories had to go out the window. The passage graves of Brittany were actually far older than the Mediterranean structures they supposedly imitated. Rather than being a distant, derivative ripple of Mycenaean or Egyptian glory, Carnac had to be considered

as one of the world's greatest fonts of Neolithic culture.

The most redoubtable constructions, however, are the famous Carnac mounds. To the naive eye, these do not look like much—symmetrical hills covered with vegetation. One of them lies very near the center of Carnac village; called the Tumulus St.-Michel, it is topped today by a small church. Only when you realize that these mounds were amassed by the hand labor of people who never knew metal tools does the magnitude of the achievement dawn on you. Zacharie le Rouzic, the great local archaeologist who excavated the Tumulus St.-Michel between 1900 and 1907, estimated its volume at 1,412,000 cubic feet. The Carnac mounds have proved the richest sites of all in terms of burial goods. From them scientists have retrieved hundreds of beautiful ornamental axheads made of jadeite, diorite and fibrolite, polished to a sheen; scores of necklaces of turquoise-colored callais; countless beads of variscite; pendants and disks of jasper and serpentine; pottery and arrowheads; and the burned bones of animals, evidently funerary offerings.

Myths and mores from Caesar to Mitterrand

What, then, are all these monuments about? What did the pre-Celtic civilization that built them intend to signify by all these prodigious and startling works of stone?

The question itself is flawed. The megalithic age in Brittany spanned a longer period—2,500 years—than has elapsed between Julius Caesar and François Mitterrand. In all likelihood, the stone structures of Carnac spring from a complex succession of cultures, each with its own myths and mores. There is evidence that some generations of megalith builders deliberately destroyed the monuments of their predecessors.

All this I was coming slowly to appreciate as I rambled on foot and by car to one prehistoric site after another. Mine was a labor of delight. Hedges of broom splashed the woods with yellow, pine sap sweetened the breeze and the songs of a dozen unfamiliar species of birds accompanied my footsteps. Each summer Carnac turns into a crowded beach resort, but now, in April, half the hotels were closed and the seacoast was abandoned by all but fishermen. In quiet cafés night after night, I ate the best oysters I had ever tasted and drank good muscadet at $6 a bottle.

One afternoon at the Bar de l'Océan, a smoky café hidden in an alley near Cornély's church, I struck up a conversation with three local octogenarians who were sipping the *vin rouge ordinaire*. They wore gray jackets, threadbare sweaters and *casquettes*—short-billed cloth caps (as had 1920s golfers). Their square, weathered faces, long noses and ruddy cheeks bespoke a region that as late as the 1960s was still so insulated from the rest of France as to seem to be almost a separate country.

After some chat about the weather, I asked the men, "And does Cornély continue to protect . . ." I was going to say "*les vaches*" (cows), but one of the old men interrupted: "*Les bêtes à cornes? Oui.*" The trio laughed hard at the hoary joke: "beasts with horns" was purposely ambiguous; as in English, the epithet covered sexually aroused men as well as cattle. I stood corrected.

It dawned on me that a deep truth might lie buried in the conventional witticism. Until quite recently, all over Brittany, the megaliths have figured in ancient folk rituals, many having to do with fertility. At Cruz-Moquen, women hoping to become pregnant used to raise their skirts to the dolmen at full moon. On the night of May 1, maidens from Locmariaquer would sneak out and slide, bare-bottomed, down the huge fallen stones of the Grand Menhir Brisé. Also at full moon, childless couples would visit the menhir called Le Vaisseau in the alignment of Le Ménec; both completely naked, the husband would chase the wife around the stone, while their parents, hiding behind another menhir, acted as lookouts.

The first 18th-century students of Carnac showed

Carnac menhirs are thought to have once numbered 10,000, extending outward in their continuous ranks.

little interest in the numerous rituals and legends attached to the monuments, sneering at the superstitions of "peasants almost as rude and uneven as their stones." Yet we know now that old stories can carry truths that last over millennia. Names can also be loaded with ancient significance. In pondering the great alignments of Kermario and Kerlescan, what should we make of the fact that in Breton the first name means "place of the dead" and the second, "place of burning"?

The spiritual resonance of the Breton megaliths through 1,700 years of Christianity is revealed indirectly in church documents. Edicts from Tours and Nantes, not far east of Brittany, in the sixth and seventh centuries threatened "*les adorateurs de pierres*" (stone worshipers) with excommunication. In 769, Charlemagne officially anathematized any Frank who failed to observe his Christian duty to destroy all pagan stone monuments that he might find in his fields. Vandalism in the name of faith did not end with the Middle Ages. As recently as the turn of the century, the fanatic Abbé Jacques Cotteux ordered scores of ancient stones hauled from their sites to make a base for a calvary in Louisfert, southeast of Carnac. Atop a mound of ruined megaliths, he erected crosses, Christian statues and plaques quoting his own poetry. Under the altar he had an explanatory footnote carved: "The debris of a bloody cult."

The very severity of the pious attack testifies to the power the stones continued to exert over long ages. By the time Christianity took hold in Brittany, early in the fourth century A.D., more than 2,000 years had elapsed since the last megalith had been erected. Today, you still can see Christianized menhirs and dolmens, their pagan spell subverted by the crucifixes that have been carved into them.

Picnicking among the alignments

The depredations of 4,000 years of vandalism are incalculable. Pierre-Roland Giot, the leading French expert, estimates that among the Carnac alignments alone, where fewer than 3,000 stones now stand, there may once have been 10,000.

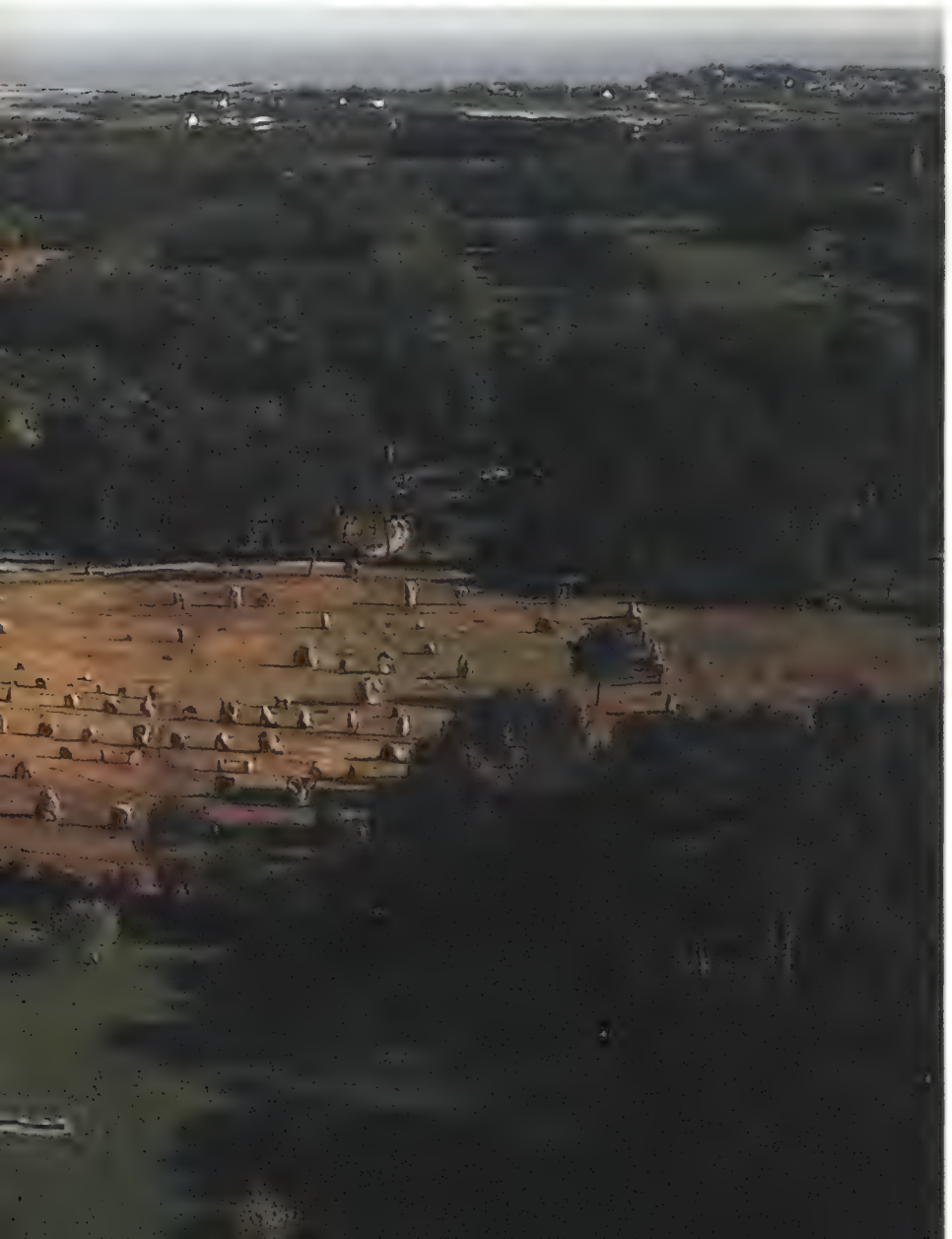
Neither national nor local authorities have done much to protect these priceless sites. Accustomed to our own national parks, I found it hard to get used to the indifference, even neglect, that hovers over the prodigies of Carnac. At first there's something refreshing about this state of affairs: you have to locate the monuments on your own, but you're allowed to putter about to your heart's content and no signs scold you with lists of "thou shalt nots." An age-old custom, and a harmless one so far as I could see, is to picnic among the alignments.

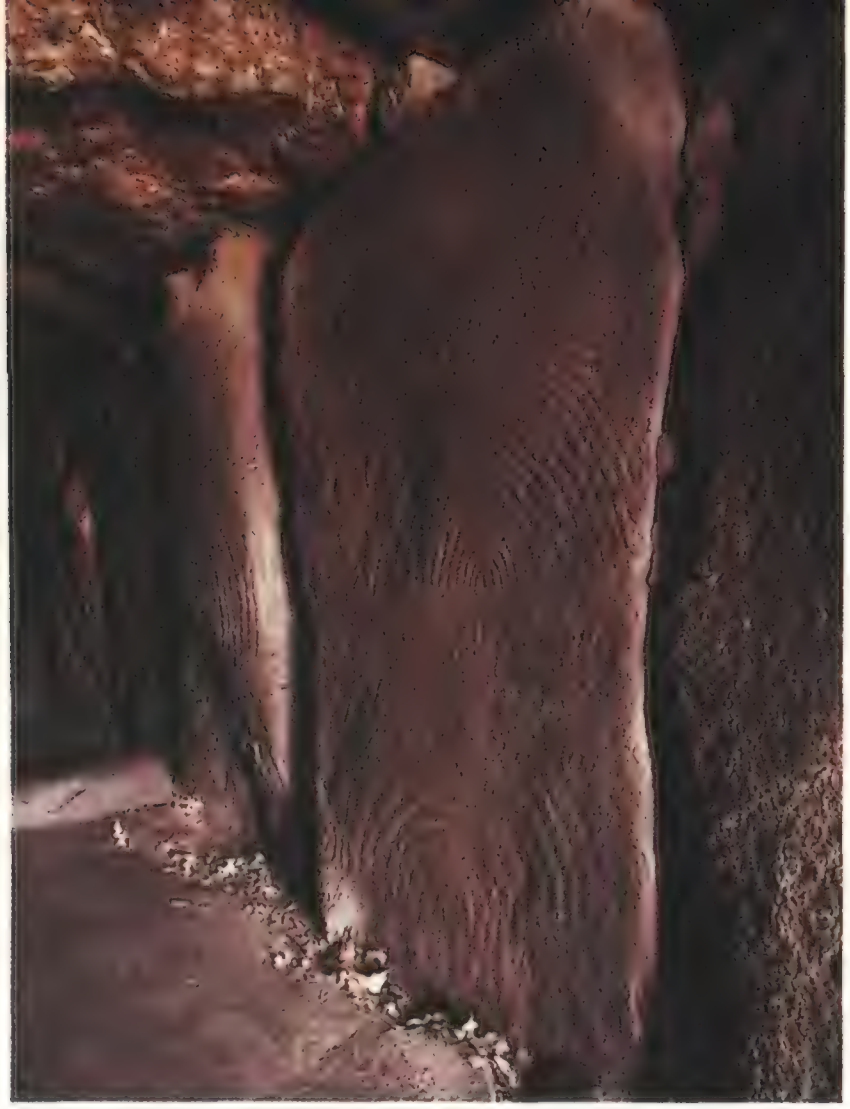
Yet at other times I was shocked by the consequences of this easygoing approach. The passage grave of Goërem, in Gâvres, has a unique architecture and several haunting carved slabs. It was discovered only in 1963, when a bulldozer cleared dunes for a new subdivision. Because it had been undisturbed for 2,000 years, the tomb was of profound archaeological value. But it was hard for me to concentrate on Goërem's beauties as I tiptoed by flashlight around the plastic wrappers, broken glass, and even toilet paper and human excrement that lined the floor of the chamber tomb.

Toward the end of my trip, I took a boat from Larmor-Baden to Gavr'inis—"Island of Goats"—in the Gulf of Morbihan. On the south edge of the island, buried in a large mound, is the most dazzling display of Neolithic art in Brittany. On 23 of the 29 slabs that line the interior of the passage grave, some master of the fourth millennium B.C. carved a riot of concentric arcs, stylized axheads and serpents, and patterns that suggest shepherd's crooks, fir trees and perhaps goddesses.

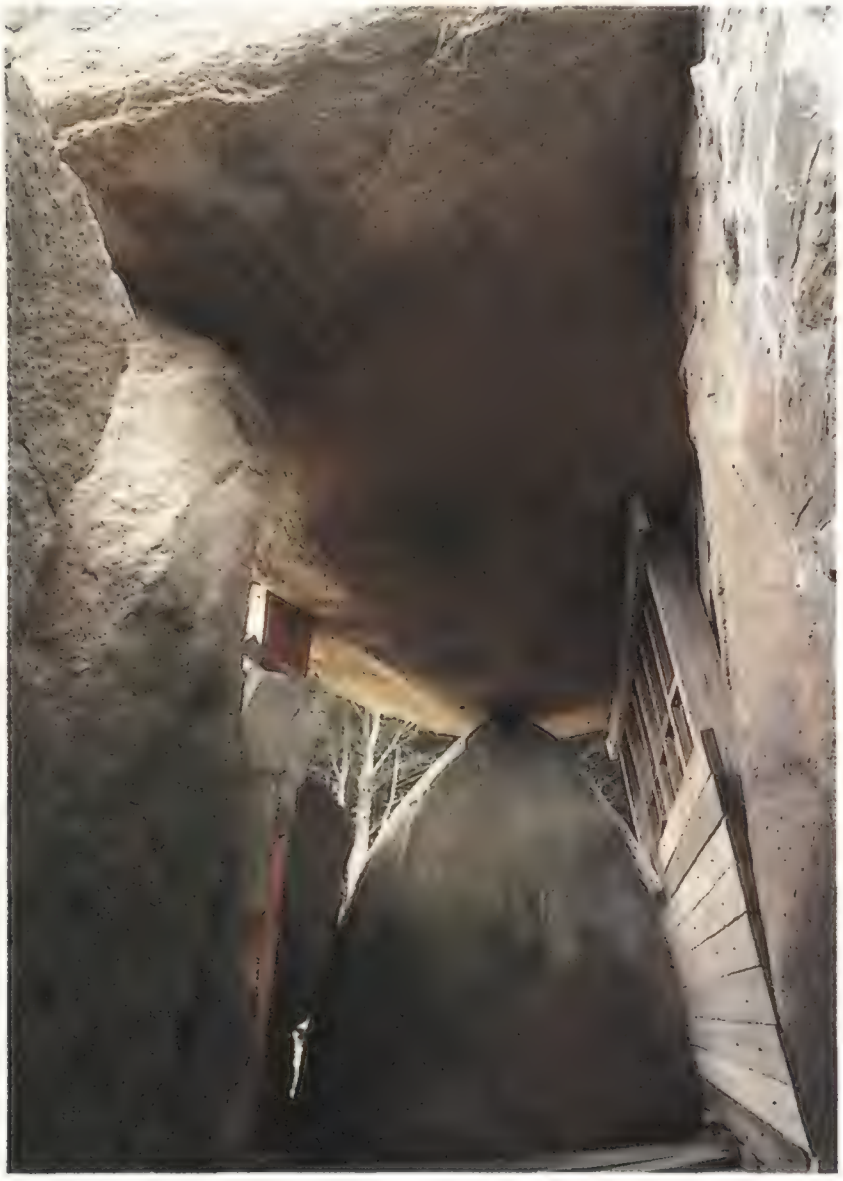
Gavr'inis was finally bought by the *département* of Morbihan in 1961, and today it is the best-protected monument in the Carnac area. Last year 30,000 tourists crawled into the tomb to marvel at its ornamented stones. The very homage of such visitors, as they brush

Gaps in Kerlescan rows (below) may indicate that some stones were borrowed for later constructions.





The passage and chamber of the tomb of Gavr'inis are decorated with typical Neolithic whorls and arcs.



Granite capstone at Table des Marchands bears hafted ax carving; the shield-shaped support is sandstone.

past one another in the narrow passage, turning with backpacks and coats that rub the walls, has begun noticeably to degrade the carvings. For the first time, in 1989 the number of tourists is being limited to ten people every 15 minutes, mornings only. With a grim look on his face, the director admitted to me that in the future, to protect its irreplaceable art, it may be necessary to close Gavr'inis to all visitors, as Lascaux and many other Ice Age painted caves in southern France have had to be closed.

At Gavr'inis, two stunning discoveries

The passage grave inside the mound at Gavr'inis was first looked into in 1832. When the site was reexcavated from 1979 to 1984, the archaeological team under Charles-Tanguy Le Roux made two stunning discoveries. It had long been assumed that the mounds covering tombs were built by piling on dirt and stones at random. Le Roux's team found instead that the mound of Gavr'inis had a deliberate, visually dramatic structure based on concentric terraces of stone, roughly like bleachers in a stadium. And when Le Roux examined the top side of the great slab that caps the inner chamber, he found incomplete carvings of long-horned cattle and a hafted ax, and realized with a jolt that they segued perfectly into the designs on the capstone of another great tomb, La Table des Marchands, more than a mile away. The only explanation seemed to be that a huge, superbly decorated slab that had once been 46 feet long—possibly a giant menhir—had been deliberately broken so that the pieces could be reused in new monuments.

The very size of the largest menhirs, of the capstones in many Carnac tombs, makes it obvious that to move and erect them required extraordinary skill and large gangs of workers. The stones, most of local granite, may have been quarried by pounding wooden wedges into natural cracks, then soaking them with water so that they would expand and fracture the rock. Dozens of transport theories, involving inclined planes of earth, ropes, rollers, levers, pulleys and even boats, have been advanced. In 1979, at Bougon, a crew of hearty volunteers set out to move by Neolithic means alone a concrete slab weighing 32 tons. Two hundred people, pulling ropes and using wooden rollers, succeeded in moving the great burden across level ground. The capstone on the tomb of Mané Rutuel, however, weighed 50 tons, and the Grand Menhir Brisé that unthinkable 340. The latter stone was apparently transported 2.5 miles from its probable quarry site to the spot where it lies shattered in four pieces today. Of such an effort by prehistoric work gangs, British archaeologist Aubrey Burl—whose guidebook *Megalithic Brittany* is the best single work on the

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Gavr'inis, the island at top, has the most elaborately decorated megalithic tomb in Europe, with low relief carvings covering 23 of the 29 upright stones. Below, Isle of Er-Lannich retains semicircular remains of a cromlech, partly covered now by Gulf of Morbihan.

monuments—writes, "this obsessive undertaking bewilders the modern mind."

The idea that the Carnac megaliths had an astronomical purpose was first advanced as early as 1874. In the 1970s, a tall, lanky, retired professor of engineering at Oxford, named Alexander Thom, crisscrossed the countryside, surveying every stone he could find. The toil was fiendish, as Thom, then in his 80s, dragged his triangulating chains through endless thickets of gorse, tearing his clothes and raking his flesh on the thorns. The Oxford don had already spent three decades studying megaliths at home in the British Isles. In a series of papers and books loaded with mathematical formulas, Thom announced a startling new view of the intellectual capabilities of Stone Age peoples.

The farflung megaliths of Carnac, Thom claimed, amounted to a highly sophisticated lunar observatory. The crucial stone was the Grand Menhir Brisé, which he was convinced had been quarried, shaped, dragged to its site and erected for that purpose. Thom thought that the ancient astronomers had used it as a sighting device; stationed at different locations all over the Carnac area, the observers lined up the distant tip of the Grand Menhir against the disk of the rising or setting moon. Then they marked their observing positions permanently by erecting smaller standing stones. In this fashion, the builders supposedly recorded their knowledge of the moon's cycle of declination and other phenomena. Moreover, according to Thom, the Neolithic observers had used their lore to predict eclipses of the moon. And they had also set out their stones in geometrical patterns based on a standard unit of length, which Thom called the megalithic yard.

These astonishing conclusions were not the work of a fanatic, but of a man who knew his science. An intricate professional debate ensued. In the 1980s, Evan Hadingham and Aubrey Burl returned to Carnac to reexamine the sites claimed by Thom to be part of his megalithic observatory. Their work, and that of other skeptics in England and France, cast serious doubt on the lunar thesis. The chief problem with Thom's theory is the multitude of stones that must originally have had clear sightlines to the Grand Menhir Brisé. Says Hadingham today, "Thom's work made archaeologists take the possibility of megalithic astronomy seriously. His achievement is that most of us now accept the notion that some imprecise level of prehistoric knowledge of the sun and moon *is* reflected in the layout of these monuments. But a lot of evidence has surfaced to suggest that it is a mistake to visualize Neolithic people as high-tech scientists. The most convincing alignments to the sun and moon are clearly not remnants of a research program, but part of a complex set of religious ideas—many of which we'll never know."

After two centuries of speculative fancy and hard-won fact, what can we finally say about Carnac?

The rich grave goods found in many tombs suggest that in certain centuries megalithic society was highly stratified. The Carnac mounds predicate an immense labor to sanctify the burial grounds of what must have been a small number of people—kings, culture heroes or priests, perhaps. And the effort of erecting giant menhirs, alignments and passage graves argues for

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Curving alignments may have generated farfetched theory that stones were placed by serpent worshipers.

coordinated workforces of hundreds or even thousands of people. Giot estimates that the industry of megalith building could have occupied as much as 60 percent of the society's "gross national product." Finally, animal bones, hinting at ritual funeral feasts, along with the wealthy objects buried in tombs, suggest a connection with a cult of the dead.

The menhirs and alignments are harder to fathom. Scholars argue that isolated menhirs may have served as topographic markers, or as commemorative stones, or even as icons in a phallic fertility cult. The alignments may have been processional lines, perhaps involving cattle. Menhirs and tombs may pay symbolic homage to a Neolithic awareness of the motions of the sun and moon. As Burl points out, the orientations of the entrances to nearly all the tombs in Brittany lie within a compass range that might be defined by such parameters as the northern and southern extremes of the moon's rising, or the midwinter and midsummer risings of the sun.

Why did these people stop building megaliths? Some scholars believe that the ancient collective values of this stone-working cult gradually faded as a new society took root in the Bronze Age. The long tradition of collective burial places—the passage graves—gave way to more modest mounds, each covering the body of only one wealthy individual.

Whatever its meaning, Carnac is now viewed as one of the great wellsprings of megalithic culture in Europe. But trying to sum up its thousands of years of prehistory, without a single written record to guide us, is a daunting task.

Says Evan Hadingham, "Many mysteries remain. We may never know the exact purpose of the alignments, for instance. But trying to understand megalithic society is easier—the builders left behind many clues, especially in the Carnac mounds. The explosion of wealth represented by these burials tells us of cattle herders who had enormous power—power to build mounds and raise stones, to obtain semiprecious stones traded all the way from the Alps and to command the sacred images engraved in their ancestors' tombs."

Months after my visit, the sheer strangeness of megalithic Carnac haunts my memory. As my thoughts come apart on the edge of sleep, I see dolmens and menhirs floating by. Runes full of meaning that our minds cannot fathom—such wonders afflict us with a terrible thirst. There is nothing to do but go back, again and again, to touch and stare at those enigmas in granite.

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While opposite in personal style, coeditors William Ferris (left) and Charles Wilson share a common vision of the South. Wilson's office (above) is full of Southern memorabilia that belies his conservative demeanor.

By Norman Schreiber

'Tell about the South. What's it like there. What do they do . . . .'

The Encyclopedia of Southern Culture *has the answers, and after ten years in the making, it's being published this month*

"Tell about the South. What's it like there. What do they do there. Why do they live there. Why do they live at all," asks the Canadian character in William Faulkner's novel *Absalom, Absalom!* These questions have been asked again and again, over the generations, about that region called the South, and no two people ever agree on the answers, particularly no two Southerners. Now to their rescue comes the 1,600-page *Encyclopedia of Southern Culture.* Literally a landmark reference, the book weighs 8½ pounds and is available this month from the University of North Carolina Press. So successful is its debut that the first printing of 12,500 is nearly sold out and a second printing is under way.

The Faulkner quote was the inspiration driving *Encyclopedia* coeditors William Ferris and Charles Wilson, and their staff, during the past ten years (it was supposed to take four) as they compiled the volume at the Center for the Study of Southern Culture at the University of Mississippi in Oxford. The result is a guidebook that escorts us through a part of America's cultural landscape that is draped in mythic hyperbole and helps us separate what's real from what isn't.

Photographs by Philip Gould

LONE SAILOR

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References to William Faulkner abound in the *Encyclopedia.* From his home in Oxford, he created "mystical, mythical" world of Yoknapatawpha County.

Eight hundred contributors, including historians, sociologists, psychologists, lawyers, folklorists, novelists and theologians, have helped the editors come up with a volume that is both a scholarly work and a browser's delight. It covers everything and everybody with any relation to the South, from baseball great Hank Aaron to zydeco, a fast, syncopated dance music of Louisiana's black Creole population (SMITHSONIAN, February 1988). The editors divided the subjects to reflect cultural themes and academic fields, and carved them into 24 broad sections that include History and Manners, Black Life, Mythic South, Politics, and Women's Life.

An overview essay introduces each section. Charles Wilson, credited with doing most of the day-to-day editorial work, found himself thrilled by many of these essays. In the Religion section, "Samuel Hill of the University of Florida did this wonderful thing," says Wilson. "He talks about the ritual of baptism, about how it is the central ritual of Southern Protestant churches, and about its relationship to the overall culture of the region. He talks about how worship—whether gospel singing, storytelling, preaching, whatever—serves the rural nature of Southern culture. The essay takes off on things I had never read about before, heard about, or thought about, even though religion is my specialty."

Concise, authoritative articles on specific topics follow each overview. "Many entries are powerful and some are incredibly engaging," says William Ferris. "The article on collard greens enlivens this seemingly mundane topic. What are they? How are they cooked? How do they fit into poetry and fiction? Why are they so mythic in the rural South? They have a biological identity. They have a food identity. They have an association within the world of art."

The *Encyclopedia* shimmers with information about a region veiled in legend. Traveling through the reality, the reader finds the truth just as exciting and complex as the tallest of tall tales. Emory Thomas of the University of Georgia, in his article on the Civil War, writes that the "most pro-

Brooklyn writer Norman Schreiber is at home in the South and likes the music, mint juleps and pit barbecue.

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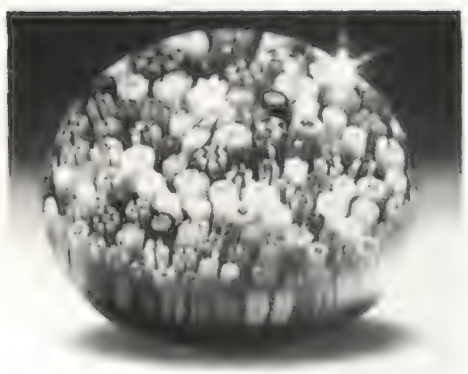

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found effect" of that war "upon southern culture occurred only after the war was lost. . . . The southern response to defeat, reunion, and Reconstruction inspired a myth-history that ennobled the destruction of the southern nation. The Lost Cause mythology held that the southern cause was not only undefiled by defeat but that the bloodbath of war actually sanctified the values and mores of the Old South."

Throughout the book, the significant is laced with the fanciful and the beguiling. The little-known fact that the "modern pompon" was invented by Lawrence (Herkie) Herkimer, a former Southern Methodist University cheerleader, is found under "Cheerleading and Twirling," tucked among major entries on basketball, boxing and fishing. It is also revealed that the three topics upon which Southerners never agree are "religion, politics, and barbecue," and that when "any southerner over 30 years of age" is asked to explain why the South has changed in recent decades, "he may begin with the civil rights movement or industrialization. But sooner or later he will come around to the subject of air-conditioning."

Familiar names appear, but their biographies reflect a marked editorial point of view. We are told that Ted Turner "has been dubbed 'The Mouth of the South'—a title intended to describe his personal style as much as his media empire" and that his major contribution to shaping Southern culture "is in his role as the 20th-century storytelling equivalent of Joel Chandler Harris's Uncle Remus."

In the Mythic South section we meet the "good old boy . . . . blue collar, an outdoorsman, a patriot, something of a populist, basically conservative—a 'man's man.'" And we are told that the late Billy Carter, "brother of President Jimmy Carter, and himself the essence of the type," defined the good old boy as "someone who rides around in a pickup truck, drinking beer and putting his empties in a sack. A redneck, by contrast, rides around in a pickup, drinking and tossing his empties out the window."

Politicians aren't spared, either. In the Politics section, listed under "Demagogues," we hear Mississippi's own former governor Theodore Bilbo denouncing a "typical pantheon of enemies" of the common people: "farmer murderers, poor-folks haters, shooters of widows and orphans, international well-poisoners, charity hospital destroyers, spitters on our heroic veterans, rich enemies of our public schools, private bankers, European debt cancellors, unemployment makers, Pacifists, Communists, munitions manufacturers, and skunks who steal Gideon Bibles."

Predictable subjects are presented with a Southern twist. In the Recreation section we learn that the "largemouth bass may have been placed in the water of the South so that fishermen have a preordained reason for idleness and spending money." Coca-Cola, "the holy water of the American South," is found under Industry, but the stronger stuff is listed in History and Manners: "From the

Book mentions that, throughout the South, "baptism outranks Communion."

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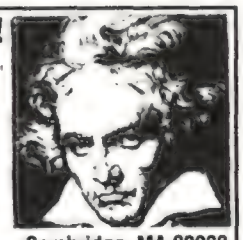

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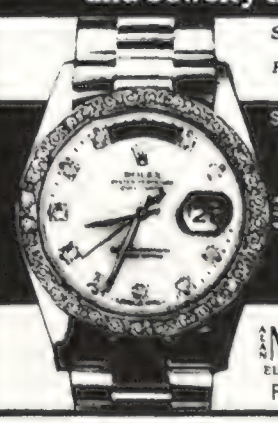

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throat-searing drop of moonshine fresh from the copper worm of a still to the dark amber waves of Kentucky's mellow bourbon in a silver julep cup, the quencher for a southern thirst through the years has been whiskey."

It is in some ways fitting that the *Encyclopedia* was conceived and born at the University of Mississippi. Every square inch of "Ole Miss" speaks of history and lore, contradiction and conflict. According to the *Encyclopedia*, the entire student body withdrew in 1861 to sign up in the Confederate Army. A century later, resistance to James Meredith's admission as the first black student at the university sparked a riot that left two people dead—but Meredith was enrolled. William Faulkner's presence is everywhere. He was an undergraduate there and lived nearby, and Yoknapatawpha County doesn't seem far away.

The Center for the Study of Southern Culture is located in the Barnard Observatory, a creaking relic of a building completed in 1859 as a science facility. Pressed into service as a hospital for Confederate and Union soldiers after the Battle of Shiloh, it was later the residence for 15 of the university's 19 chancellors. Inside the Center, the past lingers: the carpet is worn, the floors squeak and the yellowed wallpaper is peeling. Evidently the water pipes burst during a rare (for Mississippi) spell of subfreezing temperatures several winters ago. Money has recently been earmarked to restore the place.

In addition to coediting the *Encyclopedia*, William Ferris is director of the Center. Known to all as Bill, he looks younger than his 47 years, wears long sideburns, and is usually seen on campus in blue jeans and a T-shirt. His vocation is to reveal the South. When Ole Miss contacted Ferris about heading the fledgling Center in 1977, he was an associate professor in both American and Afro-American Studies at Yale University.

Born and raised on a farm near Vicksburg, Mississippi, Ferris mingles a cosmopolitan intellect with a down-home soul. He can discuss the Romantic poets and blues singer Chester (Howlin' Wolf) Burnett with equal verve. He's particularly fond of showing the similarities between blues lyrics and Romantic poems. Author of 8 books, maker of 15 films and host of a weekly radio program about the blues, Ferris is an admirer and docu-

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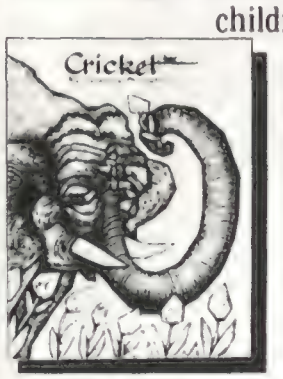

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menter of folklife's ephemeral traditions. "There is," he frequently remarks, "an African proverb that says when an old man dies, a library burns to the ground."

Ferris discussed the job offer with Yale researcher and fellow Mississippian Mary L. (Sue) Hart. "When Bill told me about the Center," she recalls, "I told him that it was the worst idea I'd ever heard. Southerners sit around contemplating their navels too often anyway." Now Hart is the research librarian at the Center and an associate editor of the *Encyclopedia*. And she is credited with suggesting the idea for the project during a brainstorming session in Ferris' Yale office. "Supposedly, the South has a distinctive culture or thinks it does anyway," she deadpans. "It was a casual idea. Bill acts on these things. Anybody else might have let it go."

At that time Ferris was a chronic outsider. He had been active in the civil rights movement in college, a conscientious objector during the Vietnam era, and a Southerner in a Connecticut Yankee university. He was frustrated in that "the further along you went in your education, the less contact you seemed to have with your cultural and community roots." Now, he is very much inside.

Ferris is a talker, a tinkerer, a listener, a networker. With a large black pouch slung from his shoulder (he doesn't like to carry things in his pockets), Ferris seems to be everywhere—in Jackson, Mississippi, for a dinner honoring the state's writers; at Moscow's Gorky Institute of World Literature for a Faulkner symposium (Ferris borrowed a guitar and jammed with Russian musicians); at New York University to speak about two of his films.

In contrast, bespectacled Charles Wilson, his brown hair topping a high forehead, projects the image of a shy scholar. But one step into his office tells a different story. Every empty space is filled with Southern memorabilia: cans of Billy Beer, a Scarlett O'Hara fan and a vial of what is passed off as Elvis Presley sweat. A historian with a particular interest in Southern religion, Wilson is known to his friends as Dr. Death. He earned his nickname by researching the mysteries and meanings of the Southern funeral. His book, *Baptized in Blood*, adds to the Dr. Death mystique. It is

"Jazz funerals are a familiar tradition in New Orleans," according to the *Encyclopedia*, but it's a "*mythic* truth" that jazz was born in the South.

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"about the attitude of religious people and religious groups toward the Confederacy after the Confederacy was dead," says Wilson. "I argue that it was kind of a cult of the dead. It had its saints and ritual occasions."

In 1981, when Wilson interviewed for a teaching job at the university, he walked away as the new coeditor of the *Encyclopedia.* He regarded the job as a "temporary period" in his career—the "temporary period" went on for eight years.

One of Wilson's first tasks was to find consultants to write the overviews. They would also help select contributors and coordinate the articles in their section. Wilson noticed that some people actually lobbied to be consultants. And just about everyone who thought he had anything to say about the South wanted to write an article. After refereeing in this arena of combative academic politics, Wilson started sending assignments to the selected 800 writers in the spring of 1982. The last article finally arrived in May of 1987.

"I think guilt played a major role in getting this project finished," says Wilson; "guilt among the contributors and my ability to play upon it." He recalls a conversation he had with a tardy writer for the Religion section: "I'm a worm," confessed the writer, "I'm worthless." The poor soul finally submitted his article and, of course, redeemed himself. Another deadline-misser embraced a charming form of self-discipline. Until his article was completed, he sent Wilson a daily personal letter describing each day's progress ("I went to the library and discovered the following facts") or delay ("When I came home I was so exhausted that I went straight to sleep").

From the beginning the staff was determined that the *Encyclopedia* was not going to be a "whites only" book. "We believe the story of Southern culture includes the blacks shaping Southern culture in the same way whites have shaped it," says Wilson. "Blacks are not a tangential part of the culture. They're a central part of it.

"Image of Martin Luther King jr. is a pervasive icon in South," says Wilson.

"The civil rights movement forced down certain barriers—legal barriers—between black and white. In a sense, the barriers in the field of scholarship have still remained in many ways. I don't think the study of black history is fully integrated into the academic curriculum. We try to correct this gap in the *Encyclopedia.* We want to show how Richard Wright is not only a great American writer and a great black writer, but a great Southern writer, and should be considered along with William Faulkner and Robert Penn Warren as part of the Southern Literary Renaissance.

"Southern blacks and whites have lived together for hundreds of years on the same soil, and despite themselves have managed to make a culture with influences on both of them," continues Wilson. "It's something that whites didn't intend to happen; but we believe it did happen." He and Ferris agree that a center of Southern culture could not have been established if there had not first been a civil rights movement.

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spection which our Center serves," says Ferris, "in many ways is due, certainly, to the changes brought about by the civil rights movement. I think the Center is a response—a part of the healing process."

The section of the *Encyclopedia* entitled Black Life is full and rich and varied. Thomas C. Holt of the University of Chicago, author of the section overview, writes: "The South provided the cultural template for forms as diverse as jazz and rock and roll, spirituals and gospels, Brer Rabbit and Stagolee. . . . black Americans have always had a love-hate relationship with the South. On the one hand, it symbolizes the worst that America has offered to blacks—racism, poverty, and oppression. But it also represents the roots of black culture, history, and 'home'. . . . a place to be escaped from; and yet a place that cannot be escaped. And finally, after the civil rights movement, it became a place to embrace: embraced less in optimism than in pride. . . ."

Two important criteria had to be established from the very beginning of work on the *Encyclopedia*. The first was a definition of "the South." Geographically it includes the 11 states of the Confederacy (Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Texas and Virginia). But it is more complex than that. Delaware, Kentucky, Maryland and Missouri were slave states at the beginning of the Civil War, and many citizens then and after claimed a Southern identity. The "census South" adds West Virginia, Oklahoma and the District of Columbia to the list. The *Encyclopedia*'s editors invoke a cultural definition, so for them the South is wherever Southern culture is found —"in 'little Dixies' (the southern parts of Ohio, Indiana, Illinois, and parts of Missouri and Oklahoma), among black Mississippians who migrated to south Chicago, among white Appalachians and black Alabamians who migrated to Detroit, and among former Okies and Arkies who settled in and around Bakersfield, California."

The other criterion was to define the term "Southern culture." The Center staff was guided by T. S. Eliot's assertion that culture is "all the characteristic activities and interests of a people," and "that culture is not merely the sum of several activities, but a *way of life*."

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"Mint juleps, roses . . . southern fashion constitute Kentucky Derby for many."

"In a way," comments Ferris, "we were pushing the contributors to think about the subject's relationship to Southern culture. You may have written about mules often; but have you thought about the mule as an animal which was a symbol of the Southern experience, as opposed to just being a work animal?"

The "Magnolia" article, for example, details the Latin names and the characteristics of various Southern magnolia varieties, and also explains their roots in the culture. The phrase "moonlight and magnolias" connotes a romanticized notion of the Old South in which charm and gentility prevail. The article also quotes blues scholar Paul Oliver's contention that "blues lyrics are unsentimental, and magnolias do not appear in them."

Each entry presents its subject in a straightforward way, but is then apt to take an unexpected turn. Kudzu, for example: "Kudzu is a weedy vine (*Pueraria lobata*) with often rampant invasive growth (a foot or more in a single day)" that was introduced into this country in 1876, and now "covers 2 million acres of forestland in the South." We also find out that James Dickey wrote a poem about the plant, and that there is a documentary film that includes a visit with the 1930s Kudzu Queen of Greensboro, Alabama (quoted as saying she was continuing the kudzu tradition "by spreading out in all directions"). And we discover a Southern rock band called Kudzu, a low-budget film entitled *Kurse of the Kudzu Kreature*, a Birmingham counterculture newspaper named *Kudzu* and Doug Marlette's popular comic strip, *Kudzu*.

Many subjects weave through a number of categories. It is no surprise that "family" is one of those topics since, as one social historian has written, in the South "roots, place, family, and tradition are the essence of identity." The entry on *The Waltons*, television's long-running series, goes further than the brief description of the show that "gave viewers a romantically idealized picture of the rural South." It proceeds to say that the show "equated poverty with an elevated moral sense, idealized rural living, and proposed eventual solutions to every family problem that arose. Nowhere in sight were complex issues such as social isolation, divorce, alcoholism, troubled children, lonely elders, or other crises that plague many American families."

It is important to remember that the book is an encyclopedia—not just a bunch of stuff about the South. Bibliographies accompany the articles. All cited facts had to be verified; opinions and unverifiable statements had to be clearly labeled as such. It can be relatively easy to confirm the year a certain 18th-century painting was completed, but building a bibliography for that caramel-like confection called a Goo Goo Cluster, "the

Two cousins "jes' set" on a favorite bench, "telling stories" and whittling.

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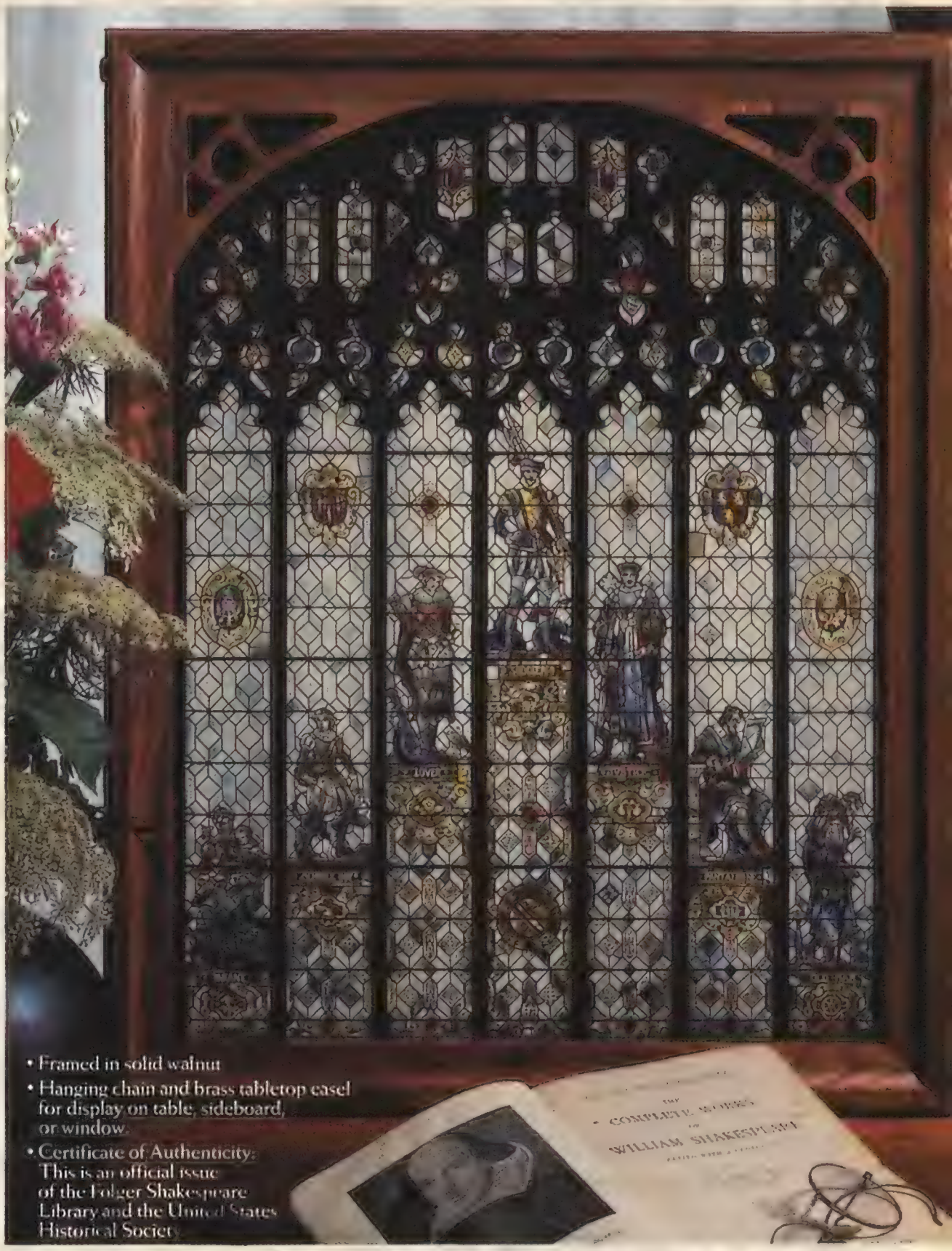
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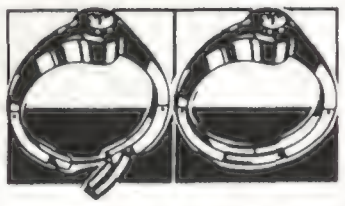

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South's favorite candy," or for the Moon Pie, "the original marshmallow sandwich," can be sticky.

Submitted articles ran the Center's gauntlet of pointy objects. Bill Ferris made his manuscript notations with a purple pen; Sue Hart's was red; Ann Abadie, also an associate editor, marked in green; Charles Wilson edited with a blue pen. Copyediting was done in pencil. Sometimes writers neglected to give the necessary Southern angle, so their articles were either returned for revision or provided with the appropriate Dixiefication. Wilson's constant trips to the library made him knowledgeable about more subjects than he ever intended to be.

The articles were read, evaluated, revised, reread, copyedited and finally entered into the word processor. Wilson felt strongly that the computer should have a Southern name, befitting its mission. To outsiders, it is a CPT-1; but to folks at the Center, it's just plain Bubba.

The Center has become a focus for the diaspora of the Southern experience. Ferris tells stories of scholars

Classic Southern plate lunch—"meat and three"—is basic fare at local cafés.

Kudzu, a weedy vine with rampant growth, "covers anything in its path."

and government officials from other countries who feel a bond with the South's tormented past and its multiracial community. The South's music and literature beckon to people from all over the globe. Not everyone who visits is an academic. Quincy Jones, composer, arranger, record producer, came to Oxford to research the music of the 1920s South for the film *The Color Purple.* A friend, writer Alex Haley, advised him to contact the Center. Ferris became a consultant to the film and coached Ghanaian actress Akosua Busia (who played the role of Nettie) on her Southern accent.

The Center has a broad teaching mission. Undergraduate enrollment in the innovative Southern Studies program is up and a graduate program is now in place. More important, students have an opportunity to confront and consider their own notions of Southern identity.

"Some of the best papers in the introductory course have been by students writing about their families," says Ferris. "One student did a beautiful piece on her grandmother, a newspaper editor in Belzoni, Mississippi. She was a very courageous and liberated figure. The student really met her for the first time through this paper. In the process, she unveiled a major portrait of a Southern woman who lived earlier in the century."

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the English department and the Center, and attracts Faulkner scholars and ordinary Faulkner lovers. Each conference has a theme (this year it was "Faulkner and Religion") and papers are presented. Nevertheless, attendees —scholars and buffs alike—bring a certain Trekkie giddiness to the event as they happily traipse over to Rowan Oak (p. 164), the great writer's home, and visit his favorite haunts.

The Center draws visiting scholars, and sponsors music festivals, art exhibits and symposia. It also produces books, publishes magazines and newsletters, and is a resource for writers and journalists.

But this year the Center's star attraction is unquestionably the *Encyclopedia of Southern Culture.* Ferris hopes that in addition to the book's popular appeal, it will provide a special resource for literature, history and music, and give readers a holistic view of the region. It is expected to be a map for charting new fields of Southern study—women in the South, ethnicity, black life and culture, and science and medicine. The goal is to move beyond the ivory-tower vision of education and touch people in the streets—not just in Oxford, but everywhere.

Yet the *Encyclopedia* offers even more. It illuminates all corners of the South. Alex Haley thinks the *Encyclopedia* is a major contribution to Southern literature. "Its greatness," he says, lies largely in its having been "compiled by many researchers who did not simply read books but who rubbed shoulders with those whom they interviewed and recorded and studied. They walked and talked with the sharecropper farmers, the cooks, the quiltmakers, the convicts, the merchants, the fishermen, and all the others who make these pages a volume of living memories."

Perhaps it can now be said that when an encyclopedia is created, an old man is born.

When Jeff MacNelly spoofed the South (his adopted home for years) in this cartoon for the *Chicago Tribune,* the Center made it into a poster to promote the *Encyclopedia.*

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By Robert Wernick

The godfather of the American Constitution

Montesquieu, a French baron with radical ideas, bequeathed us our 'checks and balances'

As a worldly magistrate, Montesquieu had his portrait painted in formal costume as the deputy president of the local *parlement* in Bordeaux.

First novels are often erotic and almost always autobiographical. *The Persian Letters,* one of the earliest and most famous of European novels, published anonymously in Amsterdam and a runaway best-seller of the 1720s, is a bit of both.

Its author, Charles-Louis de Secondat, Baron de La Brède, Baron de Montesquieu, winegrower and man of letters, nobleman and philosopher of liberty, is having the 300th anniversary of his birth celebrated this year. By a happy coincidence this is also the 200th anniversary of the convening of the first Federal Congress empowered under the new American Constitution. Curiously enough, we began to exist as a nation upon the adoption of a Constitution drawn up by men who knew Montesquieu's political views practically by heart and regarded him as an oracle.

The young man who brought out *The Persian Letters* in 1721 was a long way from being an oracle, but the cast of his character was already formed. He was bright, irreverent and fascinated by the ever-changing spectacle of 18th-century life. The novel consists of a stream of imaginary letters flowing back and forth between Persia and Paris. Two young Persian noblemen, Usbek and Rica, have gone abroad to observe the exotic customs of the Europeans, which gives the author a chance to poke a good deal of fun at the laws and morals, doctors and lawyers and society ladies of Paris that flourished during the reign of Louis XIV, the "Sun King"—all seen through the bemused yet coolly rational eyes of complete outsiders.

Their letters, describing the odd and irrational ways of the West, are matched by letters written by wives and eunuchs of the harem back in Ispahan. Of course, the missives from home reveal a life far more odd and irrational than anything Usbek and Rica are lampooning abroad. Usbek, the mild-mannered Persian gentleman visiting Paris salons, is a despot in his own harem, with power of life and death over a number of women who are allowed to see no other man and who have no function in life except to satisfy their husband's every whim. While the master spends months, and finally, years, sending them sprightly letters about the manners of the infidels, the women pour out on paper their repressed sensuality, their peevish jealousies and resentments and childish tantrums. From a safe

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At 1787 Convention, James Madison often quoted from Montesquieu.

distance Usbek tries to calm them down. The book ends melodramatically when Roxana, the most cherished of Usbek's wives, is caught in bed with a lover, declares her independence and kills herself.

In real life Montesquieu never had the bad taste to imitate literature. No suicide, in fact no display of violent emotion of any kind, was to mar his well-regulated existence. Passion rather bored him. One person in love, he observed, was very much like any other, while the world of ideas was full of infinite variety. He took a cool, distant view of his own as well as other people's behavior. His wide-ranging studies had taught him that the same actions can take on very different aspects at different times and in different places.

Like Usbek, he was an aristocrat who never really had to worry about where the money was coming from. He had forebears in both the sworded nobility (*noblesse d'épée*) and the gowned nobility (*noblesse de robe*), those high-born, black-frocked men who, from the 15th century until the revolution, dispensed the laws of France from seats in the regional *parlements* of the kingdom. Despite their name, the *parlements* had little in

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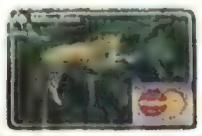

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common with the English Parliament. They were primarily law courts, and a seat in any one of them—like most administrative posts in the French government of the ancien régime—was a commodity that could be passed on by inheritance, as Montesquieu's uncle did to him, or sold to the highest suitable bidder, as Montesquieu himself would do at age 36 when he got tired of his official duties and needed a little extra cash.

As a great landowner and a *parlementaire*, Montesquieu accepted the privileges and prejudices of his class. He knew the limitations of the *parlements*, but he defended them on the grounds that a man who had put out a good deal of money to get a government office was more apt to show independent judgment than one appointed by the king and serving at the royal whim.

From a 20th-century standpoint, his private life looks more like Usbek's than perhaps he would have appreciated. His profitable marriage with a Protestant woman, only a year before his uncle's death, made Montesquieu extremely rich. Although he appreciated his wife (she was a first-rate

Mr. Wernick, a regular contributor, wrote about Philippe Egalité and the French Revolution in the July issue.

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housekeeper and bookkeeper), he paid as little attention to her as possible. She remained devoted to him, competently managing the chateau and vineyards of La Brède while he traveled, visiting the leading intellectual figures of England, Germany and Italy, or kept up a fashionable bachelor's establishment in Paris. He had a number of affairs with ladies of quality, some of them stormy—but never stormy enough to disturb the equilibrium of his life. The most important thing about an affair, Montesquieu said, was to know how to break it off cleanly once the thrill was gone.

At La Brède, he said affectionately, Nature wore her bathrobe, and he regularly went back to enjoy the place at grape-picking season, staying until he had overseen arrangements for selling his wine to discriminating customers all over Europe. He had three children, including a daughter Denise, of whom he was very fond. But noble lineages are not built on fondness. When it became clear that his only son was not going to have a male heir, he married off Denise, much against her will, to a third cousin twice her age. He was a dull creature, but the match would perpetuate the name and keep the property in the family.

What Montesquieu really considered important, however, was study and the play of ideas, mostly to be found in Paris when he was free of all his family affairs. This was the great age of witty but serious conversation, a perpetual play of give-and-take among the finest minds in Europe. Though his ideas had his own personal coloring, they generally reflected the intellectual climate of the day. This was the dawn of the Enlightenment, and a radical and self-confident group of thinkers, known as philosophes, were proposing nothing less than tearing down the structure of ideas on which European civilization had rested for centuries and putting a new one in its place.

They had grown up in a world in which it was assumed that chaos could best be kept at bay if speech, thought, trade and faith were regulated by the central authority of church and state. In the face of all that, the philosophes preached about freedom of thought

Moated chateau of La Brède, as well as many acres of rich vineyards in the Bordeaux wine country, is still in the Montesquieu family.

Denise was Montesquieu's favorite daughter and carried on his bloodline.

and speech, equality under the law, separation of church and state, religious toleration, representative government, public education, individual rights—liberties that the Western world now takes for granted, as if they had always existed as part of the human heritage.

Eighteenth-century intellectual activity in France was typically conducted in a *salon*, where a society hostess would regularly invite a group of congenial people for food and civilized talk. Like the cocktail party, its much-debased modern derivative, the salon provided an opportunity for exchanging gossip, for amatory intrigue, for pulling delicate political strings. Its main function, however, was to stimulate freewheeling discussion of new and provocative ideas. In the salon of an expert hostess like Julie de Lespinasse, the guests were "so well assorted that they were in harmony like the strings of an instrument in the hands of a skilled tuner."

Whenever he visited a new town, Montesquieu liked to climb up a high tower and get a good overall look at the place, then come down and exam-

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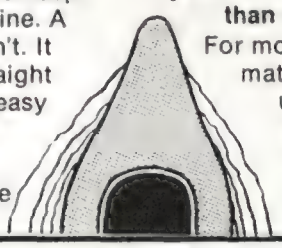

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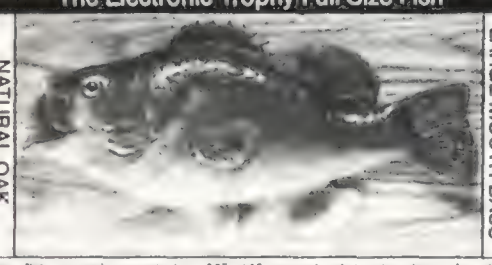

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ine different parts of it at leisure. He approached intellectual problems in rather the same way. This was the Age of Reason, before specialists and experts had taken over everything, and a well-educated man might still claim all knowledge as his province. Montesquieu presented to the Academy of Bordeaux learned papers on such heterogeneous subjects as Echoes, the Transparency of Objects, and the Uses of the Kidney Glands. He made an Olympian survey of general principles, then leaped down among the details, following them with no fixed plan, much as they might come up in the course of a brisk conversation with such philosophes as Helvétius and Voltaire, in the salon of Madame de Tencin or Madame Geoffrin.

This was not an efficient method of studying the physical sciences, but it was suited perfectly to the loose-jointed masterpiece on which he spent 15 years or so of his life—and to which he was still adding variations when he lay old and blind and dying in his library at La Brède. This work is *L'Esprit des Lois* (*The Spirit of the Laws*) whose more than 600 chapters are grouped in 31 books. Completed in 1743 and published in 1748, it is one of the most influential works of all time, a treatise celebrated enough to have a big city street named after it: Bordeaux's Boulevard de l'Esprit des Lois. *L'Esprit* is a grab bag of general principles and particular observations, with a theory of government, and many reflections on ancient and modern history. Montesquieu also commented on the influence of climate on national character and wrote an outline of what (a hundred years later) would receive the name of sociology. The section that had the most impact on America dealt with the separation of powers (legislative, executive and judicial), drawn from his conversations in England with Viscount Bolingbroke.

Montesquieu began with the then highly radical premise that laws are not the result of a divine revelation to Moses or Lycurgus or any other of the traditional lawgivers of antiquity, but a natural evolution out of everything that influences the life of a country, including climate, soil, habit, tradition, history, religion and even how the inhabitants make their living. A rational man, he said, could study

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Philosophes debate such revolutionary 18th-century notions as religious toleration and equality under law. Man with his hand up is Voltaire.

these matters the way Newton had studied the natural world, and use the knowledge to adjust the laws of his country in the direction of greater liberty for all. As two of Montesquieu's most avid American readers, James Madison and Alexander Hamilton, put it in the *Federalist* papers, men were now capable of "establishing good government from reflection and choice," instead of having to "depend for their political constitutions on accident and force."

Madison and Hamilton were babes in arms when *The Spirit of the Laws* appeared in 1748. Great Britain's colonies in North America were just that, part of the British empire and proud of it. They would soon help the mother country fight a great war against French colonists and their Indian allies to the north and west. Nevertheless, it was in these English colonies that some of Montesquieu's notions took deepest root.

When Americans began to grow restive under the distant rule of England, Montesquieu's writings provided them with a framework of ideas into which they could fit their grievances and their aspirations. In England, Boling-broke had taught Montesquieu to dislike statesman Robert Walpole's tight hold on the Colonies in the reigns of George I and George II. Now the Colonists used Montesquieu to strengthen resistance to George III.

They believed that their rights were guaranteed by the constitution of England, but there was no written constitution of England they could appeal to. The English constitution was, and still is, an unwritten fundamental consensus of the proper rules of governing for the British nation. In fact, in 1748 there had never been a nation anywhere in the world with a written constitution. But, as a great admirer of the English, Montesquieu recognized that in England something new had evolved. It was "neither a classical republic nor a feudal monarchy," as Professor Judith Shklar put it in a paper read at a symposium on Montesquieu held in Washington, D.C. last spring, "but a liberal state, with a representative government, separation of powers, and judicial enforcement of personal rights. By explicating this new order so succinctly and clearly, Montesquieu in effect wrote out a new English constitution that

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was the equivalent of a first draft available to future constitution-makers."

The blueprint Montesquieu furnished Americans had two important features, both from the wonderworking *Spirit of the Laws,* Book XI, Chapters 3 and 6. One important idea was the definition he gave to "liberty," that watchword of the American Revolution. "Liberty is the right of doing whatever the law permits." To Americans, in 1776 or 1989, that meant a law-abiding citizen "had the right to be left alone." Chapter 6 gave American Constitution writers their holy writ. But, Montesquieu added, a man's sense of liberty is related to his feeling of personal safety. "In order to have this liberty, it is requisite the government be so constituted as one man need not be afraid of another."

England had such a government, Montesquieu believed, and its great virtue was a separation of the civil authority into three branches that did not overlap. "When the legislative and executive powers are united in the same person, or in the same body of magistrates, there can be no liberty. . . . Again, there is no liberty, if the power of judging be not separated from the legislative and executive powers." Nearly all the 55 lawyers and planters who served in the Federal Convention of 1787 took this lesson to heart.

At the Convention, James Madison cited Montesquieu as his authority for insisting on the separation of the executive, legislative and judicial powers in the new government, forerunner of the celebrated system of checks and balances we use today. The man more than any other responsible for our Constitution (SMITHSONIAN, September 1987), Madison also used the words of Chapter 6 as the text for his sermon on the separation-of-powers principle in his influential *Federalist* 47.

Madison encountered Montesquieu at Princeton under the guidance of President Witherspoon. Several other members of the Convention that drew up the Constitution in Philadelphia

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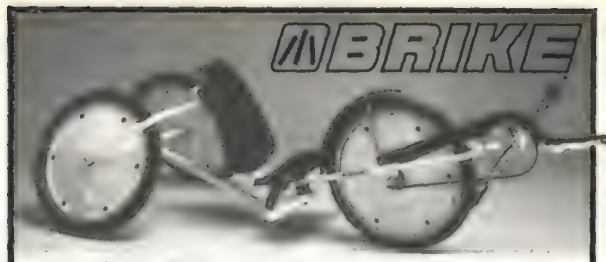
in the summer of 1787 had studied *The Spirit of the Laws* under Witherspoon, too. So thoroughly did he drill the subject into his pupils that, 20 years after leaving college, Madison could still quote whole paragraphs from memory. Madison, in effect, also used Montesquieu as a straw man, when he exploded Montesquieu's idea that republics are unstable and can exist only in a confined area—like England—with a homogeneous population. Not so, said Madison, on the Convention floor and later in his *Federalist* 10. In a small state or territory a majority could act in concert "and execute their plans of oppression." But in an extended republic such as the United States, he insisted, the large number of parties made such collusion almost impossible. "In the extent and proper structure of the Union"—a republic that would be 1,300 miles long and 1,000 miles wide—"we behold a republican remedy for the diseases most incident to republican government."

Significantly, even when Madison tried to convince his fellow delegates that, contrary to Montesquieu, the very diversity of the 13 states insured that no one group or interest would come to dominate, he did so by appealing to another of Montesquieu's precepts—the spirit of practical moderation. Montesquieu favored compromise and adjustment. Just as did the lawyers and planters of the Convention in Philadelphia, who no longer had a revolution to win but needed to set up a system that would work, he hated extremes.

Because Montesquieu had only limited faith in the goodness of human nature, he reasoned that anyone who possessed power would be likely to increase it, and the only way to stop him was by a system of rival powers, a view that the Founding Fathers, fearful alike of the tyranny by the many or the few, thoroughly subscribed to. "The oracle who is always consulted and cited on this subject," said Madison, "is the celebrated Montesquieu. If he be not



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the author of this invaluable precept in the science of politics, he has the merit at least of displaying and recommending it most effectually to the attention of mankind."

Montesquieu always had his eye on the matter of fact. His ideas might be revolutionary, but he was never a revolutionary himself. Freedom was something that grew gradually out of the history of a country, not something that could be imposed by one group of people on another. If he had lived long enough to hear Rousseau talk about the necessity of forcing men to be free, or Saint-Just proclaim that a "republic consists in the extermination of everything that opposes it," Montesquieu would have thought he was dealing with madmen.

"Political liberty," he wrote, "consists in security; or, at least, in the opinion that we enjoy security." Modern critics of U.S. Supreme Court decisions that seem to give accused persons too many rights might ponder Montesquieu's belief that "It is on . . . the goodness of criminal laws that the liberty of all subjects principally depends." Montesquieu had no illusions that men left to themselves would automatically strive for the betterment of the human race. His historical studies had taught him how efficient and long-lasting a despotism, based on pure terror and violence, could be. He would have put no faith at all in the pronouncement of another French nobleman who played a major role in the Enlightenment, Jefferson's friend and idol, the Marquis de Condorcet, who predicted that "the moment will arrive when the sun will shine on none but free men."

Condorcet was a much deeper and more original thinker than Montesquieu. A mathematical genius and a man of great generosity of spirit and breadth of vision, Condorcet had every quality except common sense. He hated Montesquieu's idea of the separation of powers because it muddied the pure radiance of his idea of universal liberty. All power to the

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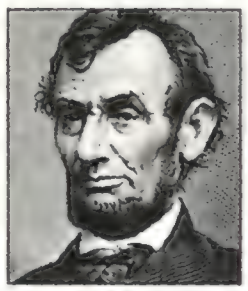

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people, Condorcet declared, and forget all this nonsense about checks and balances, which can only frustrate the people's will. Montesquieu could have told him (and he did, in Book V, Chapter 11) that if you start with direct rule by the people you are likely to end up with a concentration of despotic power that is far worse than any king's.

The French Revolution of 1789 began, true to Montesquieu's legacy, in a spirit of reform, but it was soon taken over by extremists. In the name of liberty and the people, a few hundred members of the Parisian Jacobin Club seized power and (among other things) proceeded to condemn Condorcet to death for having opinions different from their own.

Condorcet spent the last months of his life in hiding from Robespierre's bloodhounds, writing a voluminous work to prove by rigorous logic that the human mind was infinitely perfectible. One day, famished and exhausted, he stumbled into a roadside inn and ordered an omelet. When they asked him how many eggs he wanted in it, he didn't know what to say—a marquis, even an impoverished marquis like Condorcet, would never have had any reason to be inside a kitchen—and he answered at random, "Twelve." Marked out at once as a suspicious character, he spent the next two nights in jail and escaped the guillotine through death by poison or a heart attack.

Montesquieu, the winegrower who had to deal every year with the unforgiving necessities of soil, climate and human perverseness, always knew how many eggs went into his omelets. Once he had been to the top of his tower, he liked to come down and feel the earth under his feet. He had no use for the kind of philosopher who deals only with abstract generalities.

It was that solid, down-to-earth feeling which made Montesquieu's ideas so congenial to the Madisons and Hamiltons, who were trying to deal with the intractable materials of local selfish interests and build them into a united commonwealth. And that is why this suave, quietly ironic, long-nosed French nobleman became, in effect, the godfather of the United States of America.

After preaching all power to the people, philosophe Condorcet ran afoul of the Terror, but died in jail before he could be sent to the guillotine.

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Book reviews

The Arctic Wolf: Living with the Pack
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Around a campfire in the Alaskan Arctic last summer, I had the pleasure of hearing paleontologists from the University of California, Berkeley, trade tales of their most dramatic encounters with wildlife. None could match that of fossil-turtle collector Howard Hutchinson. Surveying Ellesmere Island in the High Arctic, he and his companions had been surrounded by a pack of wolves. The animals were so unafraid that one leapt up to brush the cheek of one of Hutchinson's companions.

L. David Mech (rhymes with "beach") had heard the same story years earlier. It was one of the motivating factors in his decision to visit Ellesmere in 1986.

Mech is the foremost expert on wolves in this country, possibly in the world, hands down (SMITHSONIAN, January 1985, March 1988). His graduate studies on Isle Royale in Lake Superior during the late 1950s, which documented the shifting ratio of a recently arrived wolf population to its moose prey, have long been a staple of any education in animal behavior. Since those nauseating flights over the wintry Michigan island, Mech has followed wolves in Minnesota, Alaska, Italy and Portugal, tracked leopards in Kenya, lions in Tanzania, elephants in India, caribou in the Arctic, ibex in the USSR.

Yet for all these peregrinations, Mech's dream of nearly three decades had eluded him. He never had observed, at close quarters, wolves in and around their den.

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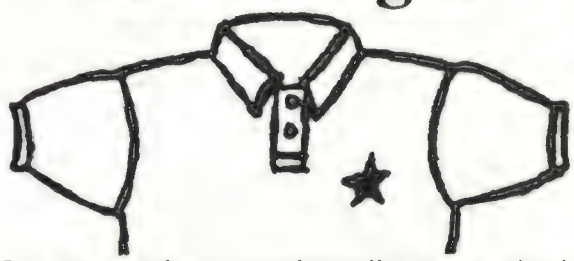

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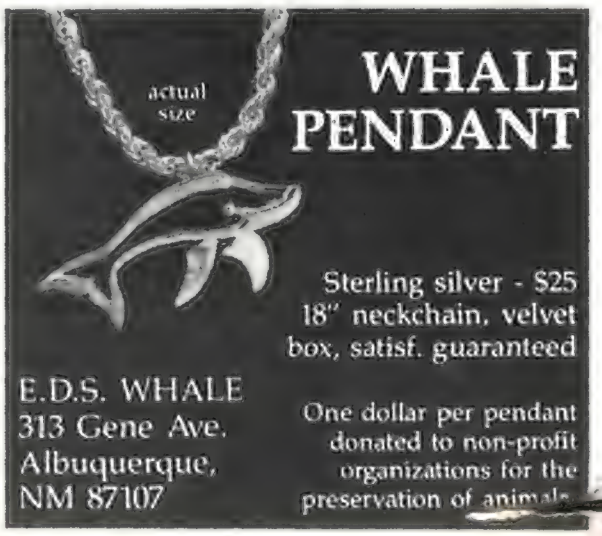
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In their remote habitat, 1,000 miles from the nearest city, 250 miles from the nearest hunter, the animals Mech encountered on Ellesmere were spectacularly approachable, as his fine color photographs reveal. He walked among the dwarfish Peary caribou, the herds of hefty arctic hare. Seabirds, long-tailed jaegers, ate from his hand. Wolves sought him out, and became so accustomed to his presence that they greeted him familiarly on his return in 1987, one of the new crop of pups playfully untying his shoelace.

Yet, even in this seeming ethologist's paradise, Mech's task was by no means simple. In a land of severely limited resources, a single wolf pack roamed a territory Mech calculated at possibly 1,000 square miles, ten times that of northern Minnesota wolves. Even in such barren terrain, locating their den was a quest of needle-in-haystack proportions. Determinedly, the burly, bearded Mech pursued wolves, their tracks and traces. In a less than balmy April (with a windchill factor of 100 degrees below zero), Mech stalked the wolves for a week.

Wolf pups, still beige "fuzzballs" with stubby ears, demand to be noticed.

He was keenly aware of the choice he presented his quarry. With "nowhere to hide in this bleak and snowy land, they had to come to terms with us or constantly run away." When they didn't run, Mech still approached warily, less fearful for himself than of disrupting the animals' accustomed routine.

When he returned that July, he came upon a wolf pack with young, and the unprecedented opportunity to observe the animals up close. As the wolves began to recognize and accept Mech, even on their long musk ox hunts, Mech became intimately familiar with them as individuals and as a society.

He recorded them—graceful, white and surprisingly slight—in candid closeup, one by one, and in playful, placating and hunting interactions. A series of shots of the cornering, killing and eviscerating of a young musk ox nearly leaps off the page in its energetic savagery. These images may well be too graphic for the squeamish, though clearly not for an "obsessed student of wolves," as Mech admits he is.

This informal account is not the place to look for an in-depth description of the ways of the wolf. It strays in narrative and loses steam after Mech realizes his den-watching fantasy. Yet *The Arctic Wolf* provides many new insights, among them the revelation of a male population markedly less aggressive in its interactions than those observed in zoos or in wild populations in wintertime. Mech attributes this peacefulness to a drop in hormone levels with the end of breeding season.

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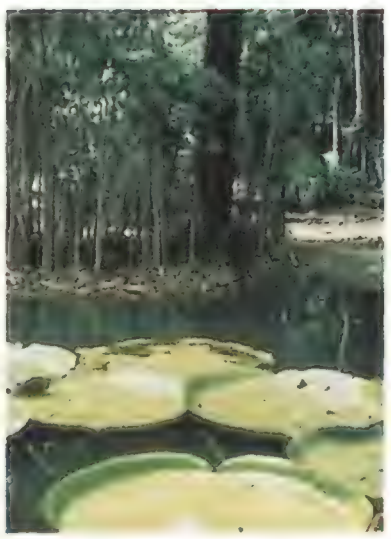

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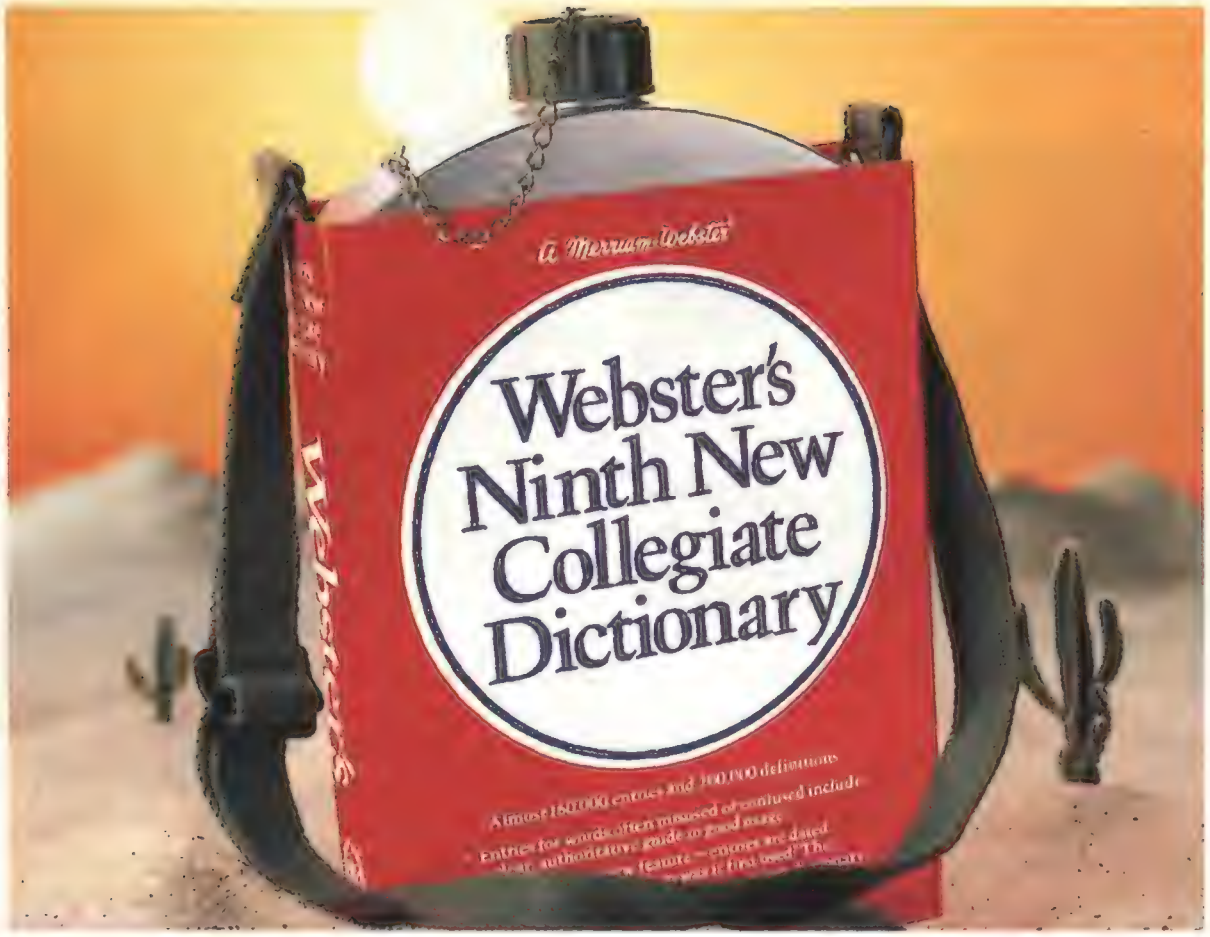

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is convey the majesty of wolves and the force of one scientist's inspiration. As impressive as the wolves themselves is Mech's caution in invading their world. Even as he exults in the "highlight of my life" he frets, "Had I done the right thing" in opening a unique wolf population to public scrutiny?

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Innumeracy: Mathematical Illiteracy and Its Consequences
John Allen Paulos
Hill and Wang, $16.95

Just when you thought education had begun to solve some of its problems comes this warning from math professor John Allen Paulos that a new strain of illiteracy—this one mathematical in nature—is plaguing the land. Paulos dubs the affliction "innumeracy" and defines it as an "inability to deal comfortably with the fundamental notions of number and chance."

Much of Paulos' proof for his theory is anecdotal; he finds evidence of innumeracy, for example, in the faulty reasoning of a weather forecaster who concludes that a 50-percent chance of rain for Saturday and a 50-percent chance for Sunday means a 100-percent chance of rain for the weekend. "The same people who cringe when words such as 'imply' and 'infer' are confused," writes Paulos, "react without a trace of embarrassment to even the most egregious of numerical solecisms."

Far more is at stake, however, than a few mangled forecasts. Paulos blames innumeracy for a number of disturbing trends, among them our flirtation with pseudosciences and the occult. Few branches of mathematics, says the author, have escaped exploitation by psychics and astrologers: "Abstruse calculations, geometric forms and algebraic terms, unusual correlations—all have been used to adorn the silliest drivel." As an example, Paulos employs a basic law of physics—the gravitational force of an object is proportional to the object's mass, but inversely proportional to the square of its distance from a body—to refute astrologers' claims that personality is dictated by the attraction of the planets at the time of one's birth. "The gravitational pull

of the delivering obstetrician," notes Paulos, "far outweighs that of the planet or planets involved."

Overcoming innumeracy is critical, Paulos believes, because a fuzzy grasp of figures can lead to muddled judgments of all kinds. To counter this "number numbness," Paulos conducts a guided tour through the landscape of mathematics, pausing to examine such curiosities as the fact that all the human blood in the world would cover Manhattan's Central Park to a depth of nearly 20 feet.

The most enlightening stop along the way is Paulos' discourse on probability. A positive result from a cancer test considered to be 98 percent accurate, he explains, is not necessarily cause for despair. If the incidence of cancer in the population at large is known to be .5 percent, then 10,000 tests will yield 49 positive results (because .005 x 10,000 = 50, and 50 x .98 = 49). At the same time, however, the cancer test will incorrectly identify 2 percent of the 9,950 cancerless people as having the disease; these 199 "false positives" will outnumber the actual positives nearly 4 to 1, meaning that the conditional probability of having cancer, given a positive test, is slightly less than 20 percent.

"This unexpected figure for a test that we assumed to be 98 percent accurate," writes Paulos, "should give legislators pause when they contemplate instituting mandatory or widespread testing for drugs or AIDS or whatever." Similar calculations, he tells us, reveal that "truthful people who flunk polygraph tests usually outnumber liars."

As Paulos and other observers of popular culture have found, debunking often involves pontificating. To avoid a too-somber tone, therefore, Paulos constantly injects such zany aperçus as this summary of evolution: "Eventually, primitive life develops, and then shopping malls." Indeed, observes Paulos, wiseacreage and mathematics share much common ground: "Both mathematics and humor are combinatorial, taking apart and putting together ideas for the fun of it—juxtaposing, generalizing, iterating, reversing. . . ."

Because of its episodic approach, *Innumeracy* comes off as a loose collection of vignettes rather than a systematic analysis of the problem. Still, Paulos radiates such enthusiasm for his topic that numerates and innumerates alike are apt to benefit from a random sampling of these pages. The resulting immersion in mathematics may lead some readers to conclude that the highest cost of innumeracy is the expense of *Innumeracy* itself, and Paulos has not told us how to figure out just how much all this knowledge is worth.

Allan Fallow
Text editor, Time-Life Books

Lot's Wife: Salt and the Human Condition
Sallie Tisdale
Henry Holt, $18.95

Too bad the phrase *vade mecum* (a sort of companion-guide) has gone the way of the full-service gas station. Because Sallie Tisdale has concocted a perfect one for us, a traveler's companion of everything we've ever wondered about that most vital of minerals, salt.

Philosophers and novelists, of course, spotted the value of salt years ago. Recently, I was struck by an observation

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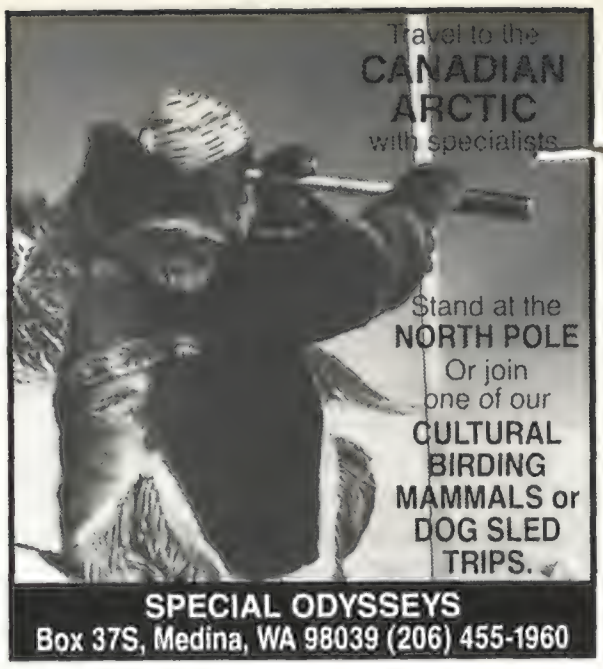
from Walker Percy, in *The Second Coming*, about "the ocean (which had the same salt content as blood and the amniotic fluid, where we were all happy)."

Percy is right, according to Tisdale. "My blood is a Precambrian composition, minerals in balance like the seawater of millennia ago," she writes. The fetus is "bathing in the salty milk of the amniotic fluid." And the intellectual thread from Percy back to the ancient philosophers is direct. Aristotle considered salt the Earth's "undigested residue," and suggested that a man might cure an elephant of insomnia by rubbing its shoulders with olive oil and salt (if he had a mind to). And he added this about the Dead Sea: "As is fabled, there is a lake in Palestine, such that if you bind a man or beast and throw it in it floats and does not sink. . . . They say this lake is so bitter and salt that no fish live in it."

Nowadays, we know much more about salt—more precisely, sodium chloride. That there is enough salt in the oceans to cover the continents with a blizzard of salt 500 feet deep. That Earth contains 120 trillion tons of sedimentary salt, spread throughout the ocean and rock. Down deep, "miles and miles into the center of the earth," in the heat, hard white salt is much less dense than the surrounding sediment. It thus migrates upward to form the great salt domes such as those that underlie Kansas and Louisiana. Tisdale captures the geology like a poet: "The conditions are ripe for motion: it rolls and sallies and drips upward, syrup between molecules of rock this and rock that, edges in like ocean breakers nudging under driftwood, slippery, viscous, flowing."

Tisdale doesn't just give us information, but *involves* us with the facts, makes us see and feel what only salt can do. Here again, on the connection between fresh water and sweat and the body's salt burden: "Sugary drinks like Gatorade, loaded with free electrolytes, are merely an expensive version of salty water—or the equivalent of beer and pretzels. For real acclimation, study the professionals: the bedouins." Conservation is the key for those desert people, she adds. They drink very little, and curdled camel's milk is their regular fare, not water.

The Romans thought so much of salt that part of a legionnaire's pay was a ration of the mineral. To this day, our English word "salary" derives from that



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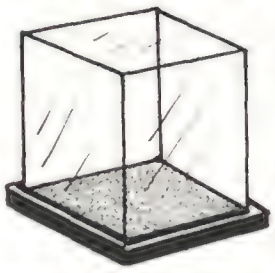

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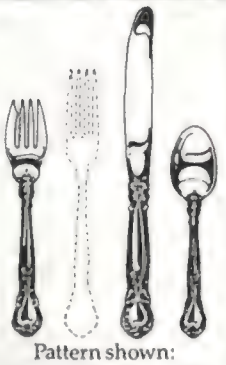

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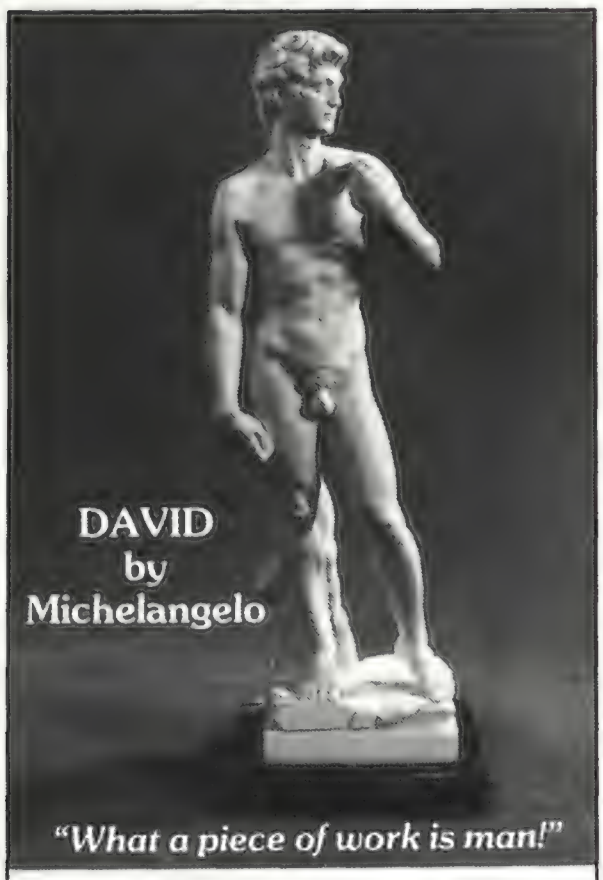

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Latin custom. To utterly vanquish a foe, you sow his fields with salt—as the Romans did after the Punic Wars.

Look how many of the world's cities are named for the salt they provided: Salamis in Cyprus, Salinae and Via Salaria in Italy, Salins in France. An American Indian tribe, the Caddo, believed salt weakened their defenses against magic. The devil cannot eat salt, thus: "the feast that wanteth salt is only fit for devils."

The strongest part of the book is its coverage of modern scientific and medical research. "Salt 'salts out' other solutes," Tisdale notes. "If sodium chloride is added to a saturated solution of carbon dioxide in water, it bumps the CO_2 away from the water molecules—the water prefers the salt. Add a pinch of salt to a soft drink and watch the bubbling increase."

I read this fine book in bedrock Calistoga, California, while marinating in a spring of geothermal hot water. Very comforting, especially since Tisdale reminds me that there is a trace of primordial salt in this pickling brine, to which I have given back a few drops of my own salt—pinpricks of sweat on my forehead, spindrift forming on the bridge of my nose. It all makes me feel a part of something greater. The Good Book, it seems, was right on the mark: I *am* the salt of the earth. You too.

Michael Olmert
Documentary television writer

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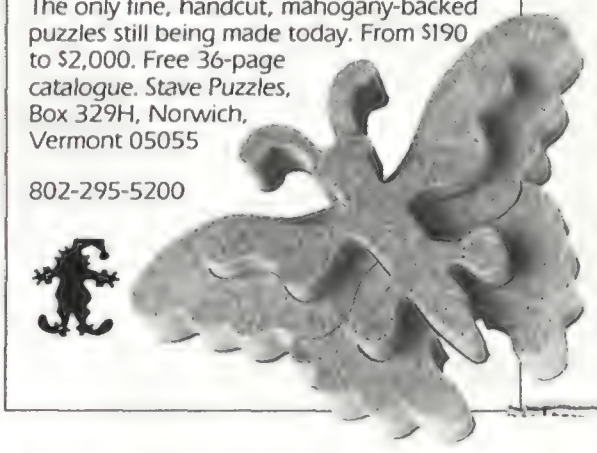

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Additional reading

Yellowstone (p. 36)

Ecological Consequences of the 1988 Fires in the Greater Yellowstone Area by Norman L. Christensen et al., Yellowstone National Park, 1989

"Fire Gods and Federal Policy" by Thomas M. Bonnicksen, *American Forest*, July/August 1989

"Incineration of Yellowstone" by Ted Williams, *Audubon*, January 1989

Rural hospitals (p. 52)

Environmental Assessment for Rural Hospitals 1988, American Hospital Association (840 North Lake Shore Drive, Chicago, Illinois 60611), 1987

The Rural Health Care Challenge, Staff Report to the Special Committee on Aging, U.S. Senate, October 1988

The Journal of Rural Health, National Rural Health Association (301 East Armour Boulevard, Suite 420, Kansas City, Missouri 64111)

Wang Yani (p. 70)

Yani: The Brush of Innocence (exhibition catalog), edited by Wai-Ching Ho, Hudson Hills Press (New York), 1989

Craters (p. 80)

Geological Implications of Impacts of Large Asteroids and Comets on the Earth, edited by Leon T. Silver and Peter H. Schultz, Geological Society of America (Boulder, Colorado), 1982

Meteorite Craters by Kathleen Mark, University of Arizona Press, 1987

The Galaxy and the Solar System, edited by Roman Smoluchowski, John N. Bahcall and Mildred S. Matthews, University of Arizona Press, 1986

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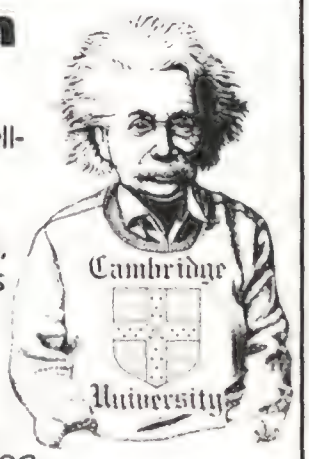

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Athletic shoes (p. 94)

"How Elastic is a Running Shoe?" by R. McNeill Alexander and Michael Bennett, *New Scientist*, July 15, 1989

The Running Shoe Book by Peter R. Cavanagh, Anderson World (Mountain View, California), 1980

Breakthroughs! by P. Ranganath Nayak and John M. Ketteringham, Rawson Associates (New York), 1986

Wild boars (p. 114)

"Feral Hog" by James M. Sweeney and John R. Sweeney, *Wild Mammals of North America*, edited by Joseph A. Chapman and George A. Feldhamer, Johns Hopkins University Press, 1982

"Razorbacks" by Bill Brett, *True West*, January/February 1975

"Wild Hogs: The Ugliest Texans" by Adrian Benke, *Texas Parks and Wildlife*, January 1973

The *Königsberg* (p. 130)

The "Königsberg" Adventure by E. K. Chatterton, Hurst & Blackett (London), 1932

Duel for Kilimanjaro by Leonard Mosley, Ballantine (New York), 1963

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Megalithic Brittany by Aubrey Burl, Thames and Hudson (London), 1985

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Montesquieu par lui-même by Jean Starobinski, Editions du Seuil (Paris), 1953

Montesquieu and the Old Regime by Mark Hulliung, University of California Press (Berkeley), 1976

Smithsonian highlights

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Castle and Freer closings

The Castle, under renovation for the new Information Center, is closed to visitors until late 1989. The Freer Gallery of Art is closed until 1992.

Special September exhibits and events

Anacostia Museum
The Real McCoy: African-American Invention and Innovation, 1619-1930 (through November 5) An overview of outstanding black inventors and anonymous innovators who made important contributions to American technology (see *Highlights continued*, page 212).

Renwick Gallery
Masterworks of Louis Comfort Tiffany (September 29-March 4) Sixty-two objects, including leaded-glass windows, ceramics, bronzes and paintings.

National Museum of African Art
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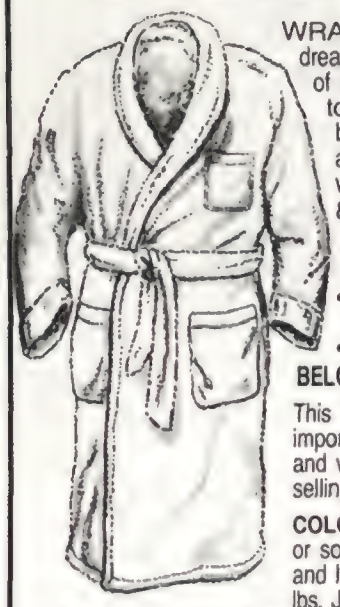

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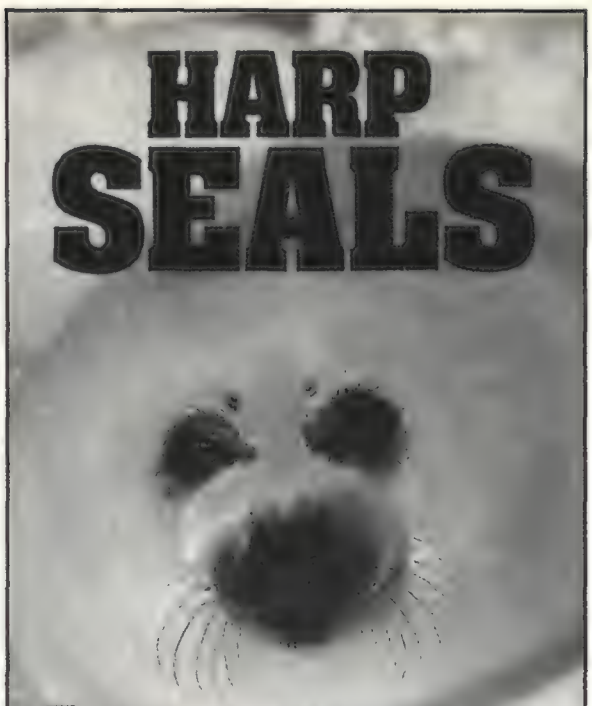

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S. Dillon Ripley Center
Caribbean Festival Arts (through February 15) Costumes, music, videotapes, photographs and performers evoke the sights and sounds of the Caribbean street festival.

National Museum of American Art
The Patricia and Philip Frost Collection: American Abstraction 1930-1945 (September 8-February 11) Seventy-five works by members of the pioneering American Abstract Artists group.

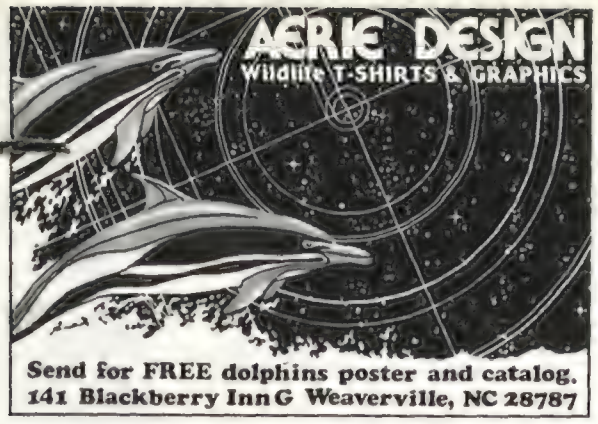
Arthur M. Sackler Gallery
Yani: The Brush of Innocence (through October 22) Paintings by the internationally renowned 14-year-old artist (see page 70).
Japanese Art: Recent Acquisitions (through December) A ceremonial palanquin and screens.

National Portrait Gallery
Recent Acquisitions (September 9-April 2) A selection of new holdings.
The Deaf Way: Albert Newsam Lithographs (through September 5) Portraits by the 19th-century deaf-mute artist.
The "Edgehill" Portrait of Thomas Jefferson (through 1992) The painting by Gilbert Stuart, on view for three years.

National Museum of Natural History
Inside Active Volcanoes: Kilauea and Mount St. Helens (through September 24) The inner workings of two fire mountains, featuring murals, instruments and interactive computerized video displays.

Hirshhorn Museum & Sculpture Garden
Robert Moskowitz (through September 17) The first major retrospective for the New Image painter.
DIRECTIONS: Keith Sonnier (through October 29) Neon sculpture by the New York artist.
Houston Conwill: WORKS (through October 29) Outdoor installation evokes the African-American experience.

National Museum of American History
Men and Women: A History of Costume, Gender and Power (opens September 20) An examination of culturally determined standards of appearance and behavior.
Workers and Managers: The Crises of Control in American Manufacturing (through February) Labor history seen through photographs and artifacts.



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European Shawls (opens September 1) Nineteenth-century wraps from the Museum's Division of Textiles.

American Television from the Fair to the Family, 1939-1989 (through April) Artifacts tracing the rise of television in American culture.

Sesame Street (through October 15) A look back over 20 years.

The Ceremonial Court Permanent installation re-creates White House spaces from 1902 to the present.

The Way to Independence: Memories of a Hidatsa Indian Family, 1840-1920 (through September 30) A chronicle of the American Indian experience.

National Air and Space Museum

Carrier Warfare in the Pacific (opens September 14) Six major battles through models, maps, photographs, films.

Eyewitness to Apollo 11 (through December 31) Paintings, drawings, interpreting the moon-landing mission.

Aeropittura Futurista: Images of Flight in Italian Art, 1913-1942 (through October 2) Works on paper and documents reflect the conception of flight through the lens of Italian Futurism.

Beyond the Limits: Flight Enters the Computer Age A new gallery explores the computer revolution in aerospace.

Cooper-Hewitt Museum (New York)

Views of Rome: Drawings and Watercolors from the Vatican Library (through October 29) Eighty-five images, traveling for the first time outside the Vatican.

Polished Perfection: The Art of Turned-Wood Bowls (through October 1) Works by 21 North American masters and four early American settlers.

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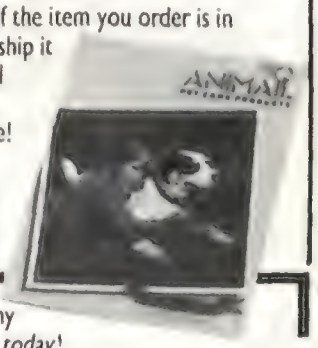
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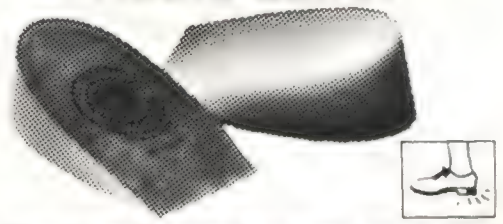
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Resident Associate Program

To become a Resident Associate, or for fee and ticket information, call 357-3030. *Dances from the Diamond Realm* (September 12; 7:30 P.M.) Tibetan monks performing ancient devotional rituals. *Athletics vs. Academics: An Evening with Arthur Ashe* (September 14; 6 P.M.) The tennis star and author on the need to reform college athletic programs. *Fine Handcrafted Furniture: From Workshop to Marketplace* (September 16; 9:30-4:30 P.M.) Seminar on contemporary furniture making.

Smithsonian Institution Traveling Exhibition Service

SITES organizes and circulates exhibitions to cities throughout the United States and abroad. To sponsor a show in your community, write SITES, Smithsonian, Washington, D.C. 20560. Here are some September exhibits:
Chicago, Illinois (September 9-November 5) *Training the Hand and Eye: American Drawings from the Cooper-Hewitt Museum*, Terra Museum of American Art.
Coral Gables, Florida (September 7-October 15) *Facing the Gods: Ritual Masks of the Himalayas*, Lowe Art Museum, University of Miami.
Flagstaff, Arizona (September 9-October 8) *Daughters of the Desert: Women Anthropologists and the Native American Southwest, 1880-1980*, Museum of Northern Arizona.
Moorhead, Minnesota (September 2-October 15) *Exploring the Planets*, Heritage-Hjemkomst Interpretive Center.

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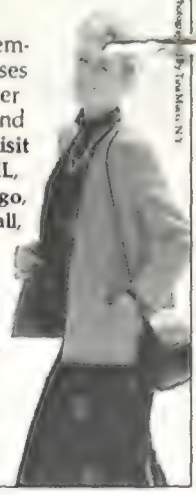

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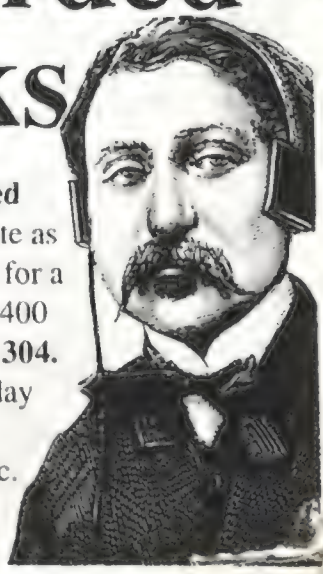

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Seminars

(continued from page 113)

Washington, D.C. *March 12-15*: Explore America's future in space, manned and unmanned.

Washington, D.C. *April 2-5*: Learn about animal communication at the National Zoo.

Washington, D.C. *April 30-May 4*: Study contemporary furniture design and visit working studios.

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Cancún Mexico *February 16-26 or February 27-March 9*: Study the effects of Hurricane Gilbert on birdlife and vegetation.

Washington, D.C. *May 23-June 6*: Photodocument Memorial Day activities.

Washington, D.C. *June 6-16*: Prepare museum collections of animal bones for transfer to a new facility.

Washington, D.C. *June 25-July 8*: Photograph the Festival of American Folklife.

Montserrat *July 1-14, 15-28 or July 29-August 11*: Excavate slave quarters and a cemetery at a Caribbean sugar plantation.

Cody, Wyoming *July 15-28*: Collect plant fossils near Yellowstone.

Cheyenne, Wyoming *July 18-30*: Document this city's annual rodeo.

New York City *August 8-18 or 20-30*: Reconstruct European and slave pottery from Montserrat.

For seminar brochures, call (202) 357-4700; for expeditions, call (202) 357-1350. Or, write to the address on page 113.

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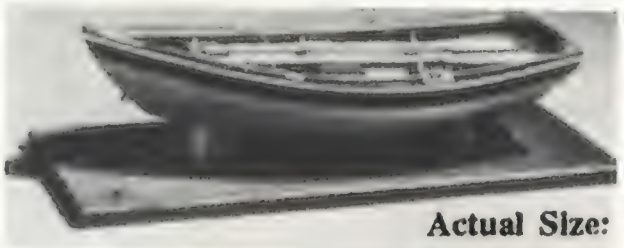

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Reclaiming some talents lost to time

When Anacostia Museum historian Portia James set out to trace the accomplishments of America's black inventors, she discovered that scholarly detective work was the order of the day. James pursued every lead, however tantalizing and fragmentary, in a search to chronicle largely undocumented contributions to technological innovation.

During the course of nearly four years, she pored over reams of old newspapers on microfilm, contacted museums great and small, tracked down private collectors and sifted through records at the National Archives. James haunted the U.S. Patent Office for drawings and specifications, foraged through the holdings of historical societies and succeeded in locating the descendants of several prominent inventors. The result of her inspired investigations, "The Real McCoy: African-American Invention and Innovation, 1619-1930," is a tribute to unsung creativity.

Take Garrett Morgan, for instance. His prototypical safety hood (bottom) saved the day in Cleveland, Ohio, one afternoon in 1916. When a crew of laborers was trapped in a poison-gas-filled tunnel under construction beneath Lake Erie, inventor Morgan, fitted out in his protective hood, led a rescue team to bring the men to safety.

Or Elijah McCoy, whose hydrostatic locomotive oiler (top, right) eliminated frequent, and costly, stops for lubrication of moving parts. (Engineers called his 1882 laborsaving invention "the real McCoy.")

Or Norbert Rillieux, who revolutionized the sugar-refining industry. The son of a New Orleans Creole family, Rillieux, who had studied mechanical engineering in Paris, patented a vacuum-evaporation method for processing sugar in 1848. His breakthrough eventually allowed American planters to dominate the market.

The show runs through November 5.
Kathleen M. Burke

Garrett Morgan's 1923 automatic signal predated standard electric traffic lights.

Elijah McCoy developed oil lubricator to streamline locomotive maintenance.

Lewis Temple brought toggle-harpoon to commercial whaling, circa 1848.

Patented in 1914 by Garrett Morgan, safety hood was a version of gas mask.

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By Michael Kernan

The chicks that stayed home in the range

I see the AGA stove is being advertised in the magazines. "Comes in two sizes and seven enameled colors," the ad says, "with a choice of natural gas, propane or coal fuel."

Two kinds of gas, eh? Great. The AGA stove I remember was strictly beige and ate strictly coal, and not much of that. I have a story about our AGA, but before that I have to tell you a lot of other stuff.

Mind you, it was a marvelous stove. Invented (according to its own legend) by Gustaf Dalen, a blind, Swedish, Nobel Prize-winning physicist, it contained large quantities of vermiculite insulation and had two burners on top, covered by massive, shiny, chromium-finished disks that from a distance looked like two futuristic fried eggs. You could pour nearly boiling water from a spigot in front. Put the water in a coffeepot and set it on the hotter burner, and it would perk coffee in eight seconds.

It was my father's great parlor trick. Every guest had to be shown the AGA and the eight-second coffee miracle. The night we had the chimney fire, the town's entire volunteer fire department was given the demonstration. We kept a kettle on hand just for these shows, preferring filtered coffee ourselves.

What a stove. "Runs on a nickel's worth of coal a day," my father would say. "Gets hotter the longer you leave it alone. Never goes out."

Well, that was Pop's style, I guess. He was an Irishman. Because it did go out, at least once a year. And since the process was gradual, you didn't realize it for several hours. Then it would take you (or rather, me) several more hours to light it again.

Let me tell you how we lit our AGA stove. There was a door, the size of a shoe box end-on, situated on the front just low enough so you had to lie flat on your stomach to see inside.

You cleared out the cold ashes (as you'd failed to do the night before, which is why the thing went out) and then reached in up to your shoulder and—by feel alone—built a tiny bonfire in there with twigs and shavings. When the bonfire was making its tiny roar, you set one piece of coal on it, shut the door and hoped it caught. If it did, you put in another piece of coal, and another, until you got a nice glow.

If it didn't catch, you swept out the shavings and started over.

There were two other doors on the front. One was for our notoriously scatterbrained oven, now hotter, now colder, which only our genius cook, Wanda, understood. She made soufflés that stood, like a chef's hat, six inches above the pan. The other door opened on a mildly heated chamber so ineffectual that we used it for a plate warmer. You couldn't even bake meringues in it.

Now my story, and none too soon. I had chickens. I was in the 4-H and had 500 Rhode Island Reds, and despised each and every one of them for what I saw as their stupidity, their dirty habits and their meanness of soul.

But they were kind of cute when they arrived, in five huge boxes punctured with holes. We put them in the chicken house with a kerosene brooder for a heat source, and right away my mother noticed that about two dozen babies didn't crowd in with the rest but stood aside, eyes squinted tight shut, little shoulders hunched.

"Oh, you have to figure on losing six or eight in every box," the farm agent had informed us.

Well! Figure, nothing! My mother took a hard look at those 24 losers, fetched a cake box and brought them up to the house. She set them on the kitchen table, got an eyedropper, fed two drops of castor oil into each tiny beak and put them down on some newspaper. Inside the plate warmer. With the door open, of course.

Napoleon, our long-suffering almost-German shepherd, was showing an intense interest in this hospital operation, as dogs will, so I put the poor fellow out. Then I brought our 21 leather-bound volumes of Washington Irving—I still can't believe he wrote that much—from the library and stood them on end so they made a little corral around the stove and the kitchen table.

Pretty soon we had a three-part staging area for reviving chicks: some still shivering in the plate warmer, some recuperating on the table, and the rest happily peeping and running around in the corral.

We saved all 24 chicks. That stove was never put to nobler use. I like to think that, two years later, when the stove went out on Christmas morning with my aunts Grace and Plowdie there for dinner, and Wanda had to abandon the turkey and serve us instead a magnificent cheese soufflé created with the last gasps of heat from the dying oven, perhaps some of those 24 survivors had provided the eggs that saved the day.

I sort of wish I had named them. You know, painted their toenails or something, so that I could have picked them out from hundreds of others. They were a good group.

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